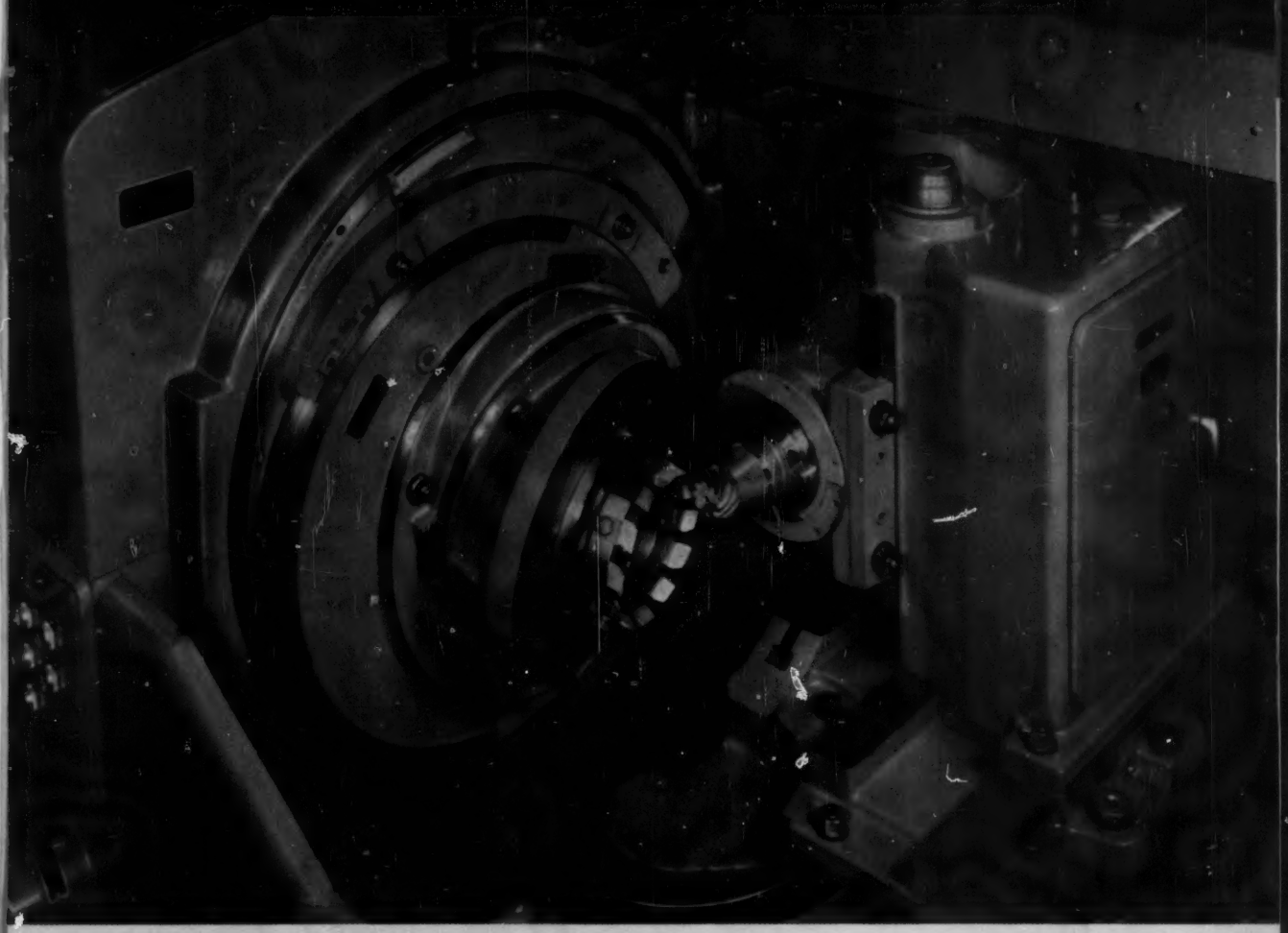
SEPTEMBER 1956—SIXTY-THIRD YEAR

MACHINERY



New generator cuts spiral and Zerol® bevel and hypoid gears faster

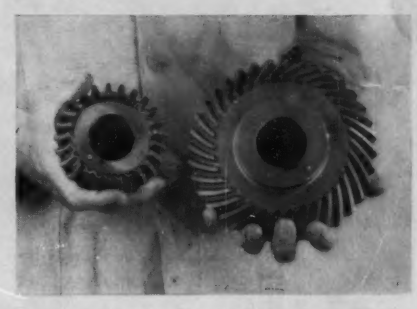
The No. 106 Hypoid Generator uses a large cylindrical cam to control its generating motion—an entirely new method that gives exceptionally efficient cutting cycles plus many other new features which allow refinement of tooth contact never before obtainable.

No. 106 can be arranged for jobbing, high-speed production, or completing. In the completing arrangement, it finishes directly from the solid.

The No. 106 also employs the new Unitool* Method for small-lot quantities, with very little capital outlay.

Write for bulletin for details of operation.

*Trademark



The new No. 106 Hypoid Generator cuts these Zerol and spiral bevel gears, as well as hypoid gears, much faster than earlier machines. Cuts any ratio up to 10:1; up to 5¼" cone distance; 2" to 8½" diameter; any pitch 4 DP and finer.

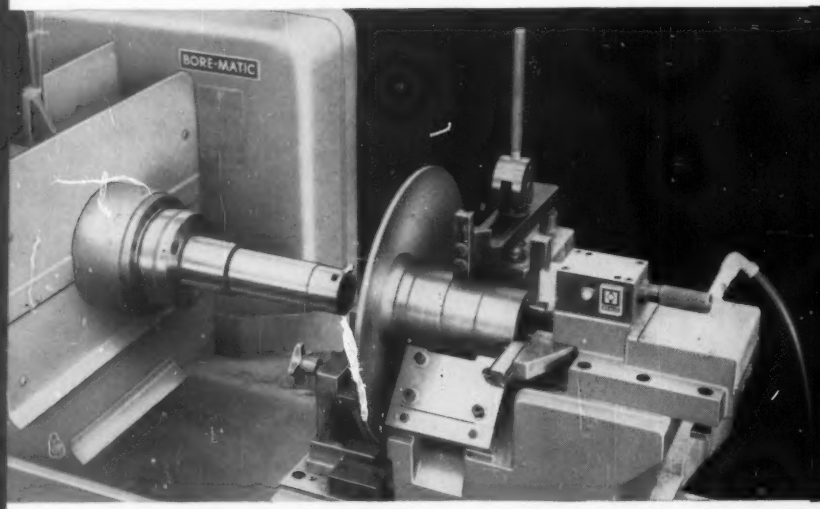
GLEASON WORKS

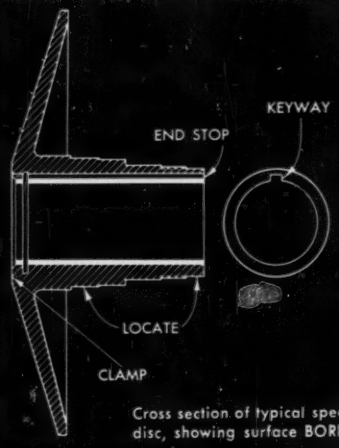
Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

The extreme versatility of Heald **BORIZING*** permits faster precision finishing of both long-run jobs and small-lot work with frequent changeovers

FOR EXAMPLE: *This One Bore-Matic Finishes 41 Different Parts, with a production increase of over 200%!*





Cross section of typical speed changer disc, showing surface BORIZED.

The Model 221 Bore-Matic shown above is equipped with interchangeable tooling and adjustable fixture for precision boring 41 different speed changer discs, with bore diameters ranging from 0.688" to 3.2510" and bore lengths from 2⅜" to 9⅜". Compared to the previous method of doing the same job, BORIZING increased total net production from 4 parts to 13 parts per hour.

It PAYS to come to Heald

**BORIZING is a copyrighted word meaning the application of any number or variety of precision finishing operations performed on a Heald Bore-Matic.*

HEALD®

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

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MACHINERY

VOLUME 63 SEPTEMBER, 1956 NUMBER 1

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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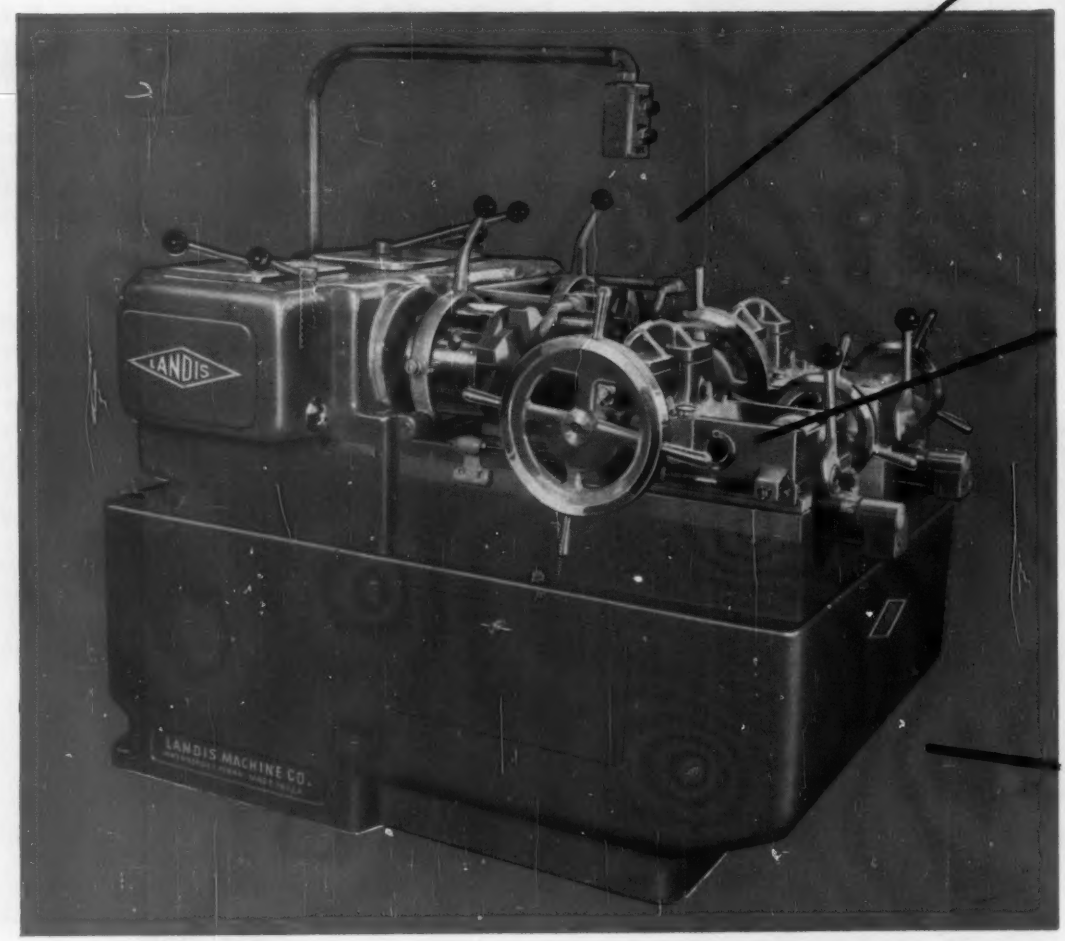
LANDMACO

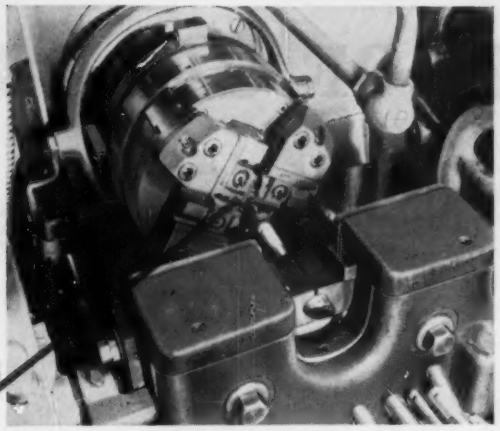
threading machines



. . . . . are built in a wide variety of models for commercial, heavy duty, and precision threading from 3/16" to 2½" in diameter.
Single or double-spindle models are available in varying bed lengths, with or without lead screw, using either of two die head styles, according to individual requirements. The die heads use LANDIS Tangential Chasers, which may be reground for 80% of their original length. Adaptation for oversize capacity and special jobs is easily made through auxiliary equipment.

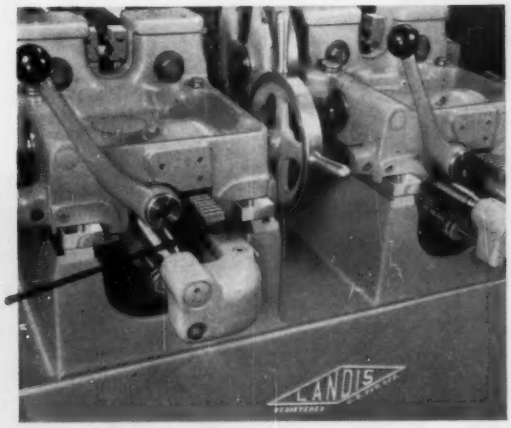
For more information, send specifications and ask for Bulletin H-76.

464C-2



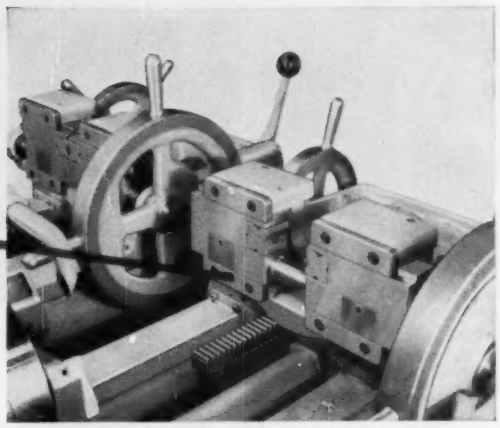
PRECISION

Hardened and Ground LANCO Die Heads combined with Lead Screw Feed enable threading to Class 4 and Class 7 tolerances. The fundamental design and specially selected and hardened materials of the die head provide the maximum rigidity required for this class work.



HEAVY-DUTY

Lead Screw Feed and rugged LANCO Heat Treated Die Heads enable the unusually heavy cuts required for producing Acme threads. Despite the heavy rate of metal removal, workpiece slippage is prevented by vise gripping power intensified by a "hammer blow" operating handwheel.



VERSATILITY

Each LANDMACO Threading Machine cuts a wide range of thread diameters—for example, the 12C LANDMACO has a standard threading range from $\frac{3}{8}$" to $1\frac{1}{2}$" in diameter, with oversize capacity to $3\frac{3}{4}$" for short thread lengths. Standard carriage vises enable the gripping of diameters larger than the machine's capacity, and special vises may be furnished. Tooling is available for Tapping, Turning, Grooving, Forming, and Facing operations.

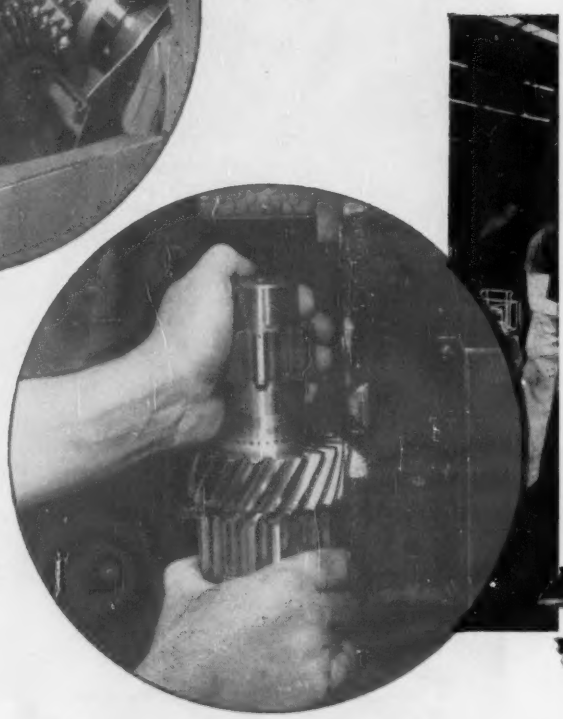
LANDIS *Machine* COMPANY
WAYNESBORO • PENNSYLVANIA

For more information fill in page number on Inquiry Card, on page 231

FOR MILLIONS OF GEARS

...Fellows

Fellows Heliguide Hobbing Machine cuts a 37-tooth gear in SAE 4027 carburizing steel on one spindle and a 27-tooth gear on the other. Production, each spindle: 35 gears per hour.



Fellows No. 4GS Gear Shaper cuts twelve 32-tooth, 7" P.D., ⅞" face helical gears per hour or seven 15-tooth, 6" P.D., 2-1/16" face spur gears per hour. Set-up shown is for 20-tooth helical or countershaft.

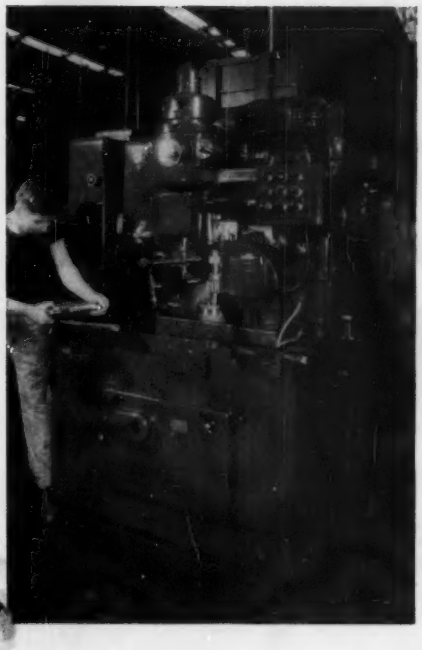
THE PRECISION LINE

A YEAR

Speed and Accuracy!

Over nine million gears a year for truck transmissions and other major sub-contracting jobs are made by the famous New Process Gear Company, Syracuse, N. Y. Their records show that because of their speed and accuracy their new Fellows Gear Production machines have lowered cutting costs by more than half!

For example, the Fellows Heliguide two-spindle hobbing machine at New Process cuts *six times* as many gears per hour as the previous machine. In addition, it saves approximately two hours in set-up time, requires only one operator to watch it because of its easy push-button operation. One man can operate four of these Fellows high-speed Heliguide Hobbing Machines.



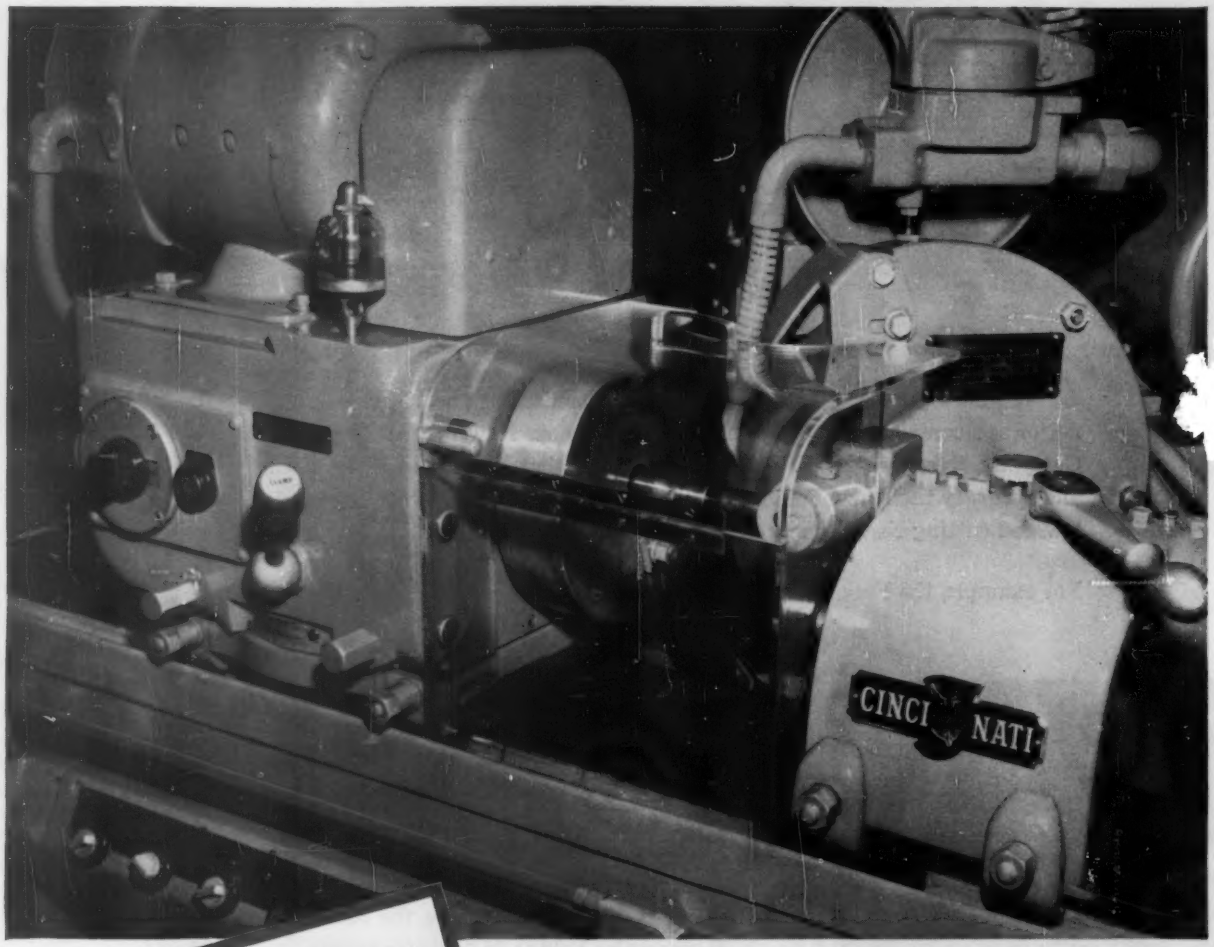
New Process gets similar benefits from each of its ten Fellows No. 4GS Gear Shapers. Cutting 30% faster than the old machines, the No. 4GS Gear Shapers also hold to 25% closer tolerance without difficulty, saving on set-up time.

For full information about the complete Precision Line of Fellows Gear Production Equipment, get in touch with your Fellows representative. Write, wire or 'phone any Fellows Office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 319 Fisher Building, Detroit 2
150 West Pleasant Avenue, Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Avenue, Los Angeles 45

Fellows *Gear Production Equipment*

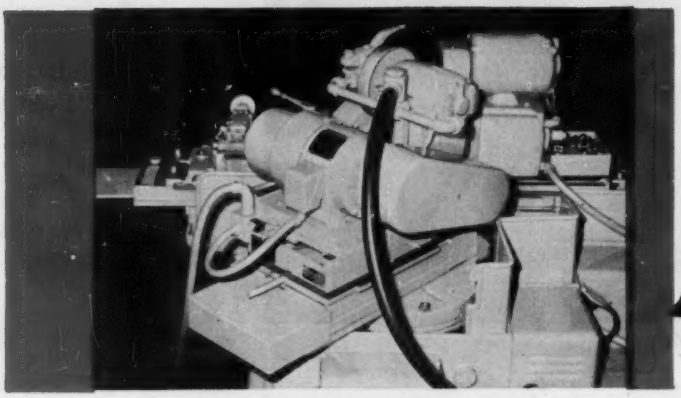
For more information fill in page number on Inquiry Card, on page 231



CINCINNATI FILMATIC 10" UNIVERSAL GRINDER

set up to grind simultaneously diameter and shoulder of titanium trip dogs. Wheel runs at 5000 fpm for these titanium parts.

FILMATIC



Double end motor and standard wheelhead swivel are shown to advantage in this view.

CINCIN

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES

This Universal Grinder Gives You Both

Versatility and Production

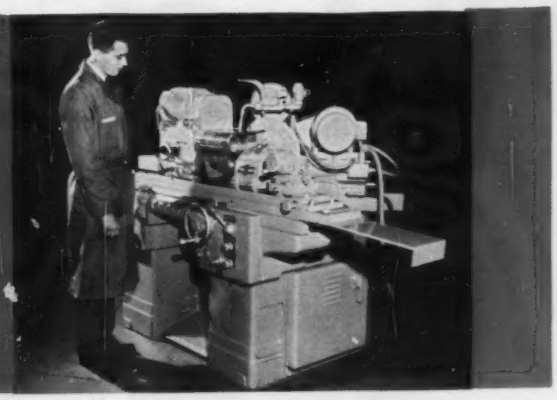
Look at your universal grinders from this viewpoint: can they handle an occasional high production job at a reasonable cost? It's routine work for the CINCINNATI® FILMATIC 10" Universal illustrated here . . . grinding the diameter and shoulder on large quantities of small titanium parts. ¶ To obtain the highest quality finish on the two surfaces, the grinding wheel has been transferred to the right-hand end of the spindle, and the wheelhead swiveled about 45°. Built-in automatic infeed equipment aids the operator in maintaining a uniformly high rate of production. An angular truing fixture simplifies the truing and dressing chore. The 10" Universal's extra measure of power is a big factor in production, too. Consider these items compared to other machines in its class:

- Largest grinding wheel; 12" dia. x 1½" face
- Most powerful wheelhead motor; 2 hp
- 50% larger headstock motor
- Exclusive FILMATIC grinding wheel spindle bearings

In addition to all these production advantages working for you on the occasional high production job, the CINCINNATI FILMATIC is a true universal. Wheelhead swivels 180° and 220°, upper and lower, respectively; headstock swivels 180°; headstock speeds are infinitely variable 60 to 600 rpm. Sounds good for your shop, doesn't it? Sweet's Machine Tool File contains brief specs.; for complete data, write for our catalog G-577-5.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

Angular wheel truing attachment for truing and dressing two grinding surfaces on wheel.



CINCINNATI FILMATIC 10" Universal Grinding Machine. Complete information in catalog No. G-577-5.

NATI

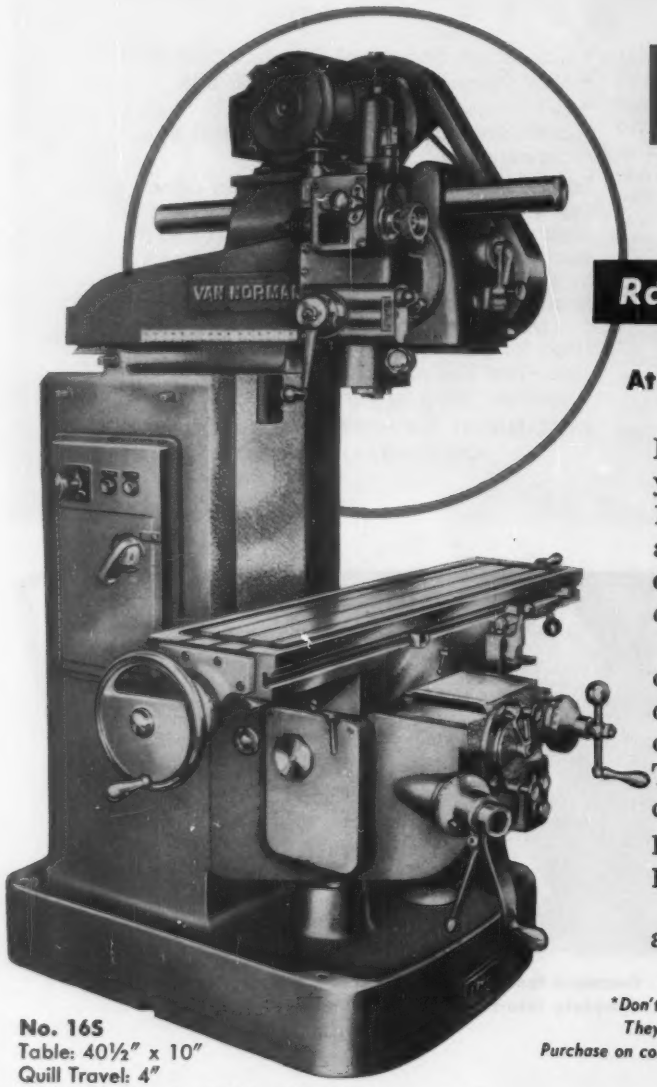
CINCINNATI

CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

This NEW Quill-Type Adjustable Cutterhead Mounted on the Rugged Heavy-Duty Ram makes

VAN NORMAN

No. 16S



No. 16S
Table: 40½" x 10"
Quill Travel: 4"
Quill Power Feeds: .0015; .003; .006
Spindle Motor: 2 HP

Ram Type Miller... the most

At a cost to you of only $4.98 per day*

Now for the price of a single machine you can get this New Van Norman No. 16S that gives you horizontal, angular and vertical milling, *plus* boring and drilling with the same machine *without attachments.*

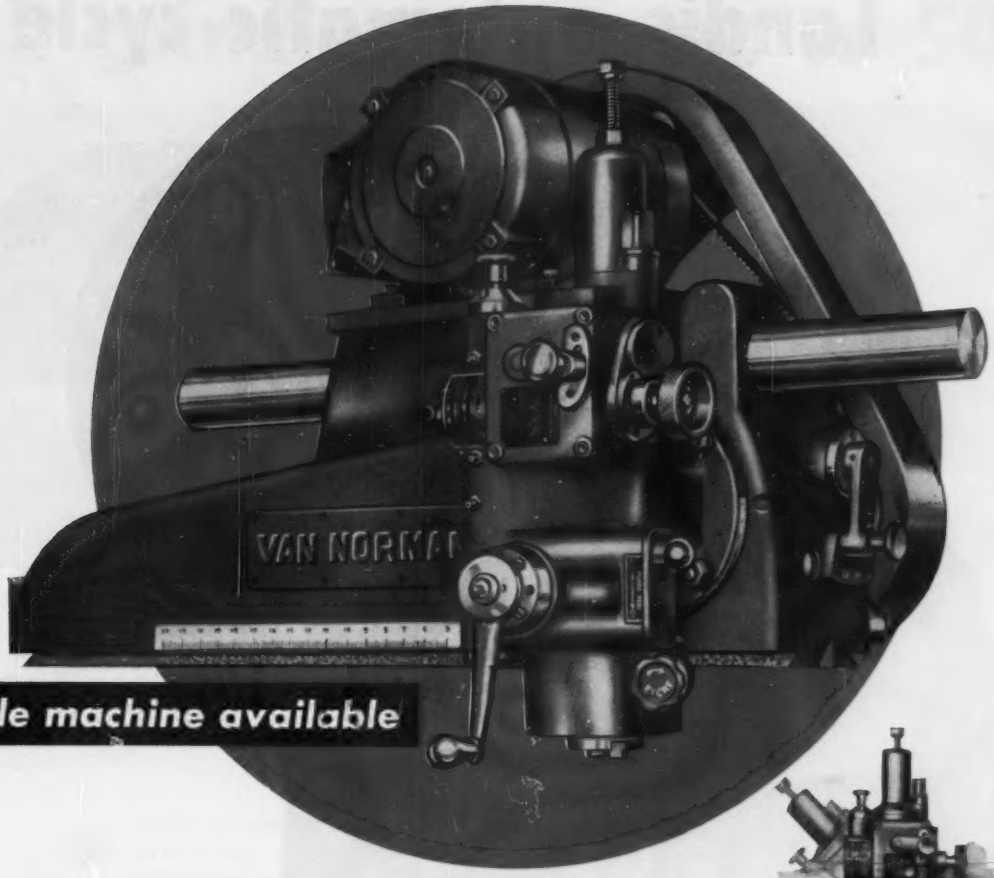
The new rugged quill-type adjustable cutterhead mounted on a rugged heavy duty movable ram increases the scope of operations . . . permits maximum cuts. The No. 16S will reduce overall work completion time . . . permits greater opportunities to cut costs and increase production.

Write, phone or wire for information and catalog giving complete details.

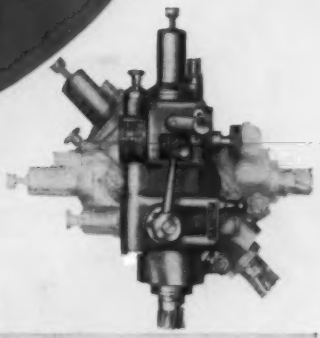
**Don't wait . . . for extra profits install a Van Norman Machine now! They are available on many purchase plans — Outright sale . . . Purchase on conditional sales contract up to 5 years* . . . Pay as you depreciate . . . See your dealer or write Van Norman Company Conditional Sales Contracts not available to Export.*

VAN NORMAN MACHINE

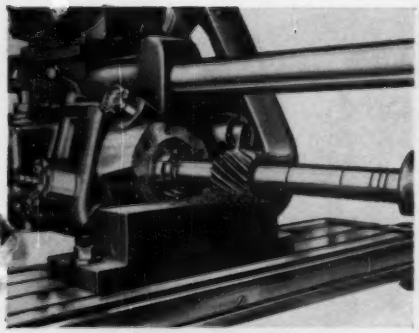
MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.



versatile machine available

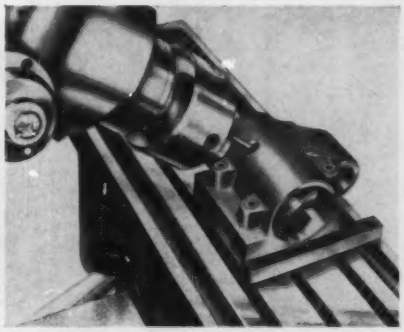


Adjustable Quill-Type Cutterhead Gives Workability of Two Single Purpose Machines PLUS Accurate Boring and Drilling



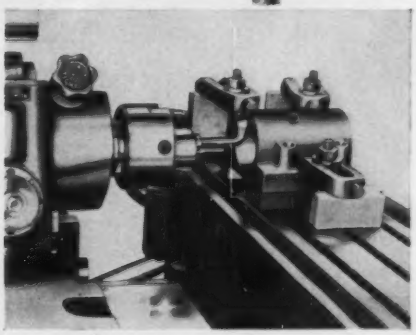
A HORIZONTAL MILLING

A horizontal milling cut performed on a cast iron base. Width of cut 2½″; Depth .25″; 3″ wide helical slab milling cutter.



ANGULAR BORING

Angular boring on a cast iron saddle bracket boring a 1″ dia. hole. Depth of bore 1¾″ removing ⅛″ stock on roughing cut. Finish cut removes .010″; Tolerance on I.D. .001″



HORIZONTAL COUNTER BORING

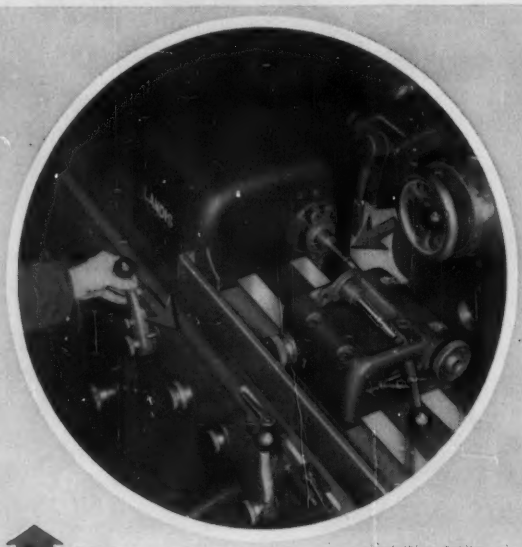
Horizontal counter boring operation of a 3″ dia. hole on same saddle bracket. Depth of cut 1″ to a shoulder removing approximately ⅛″ on rough cut. Finish cut .010″; tolerance on I.D. .001″.

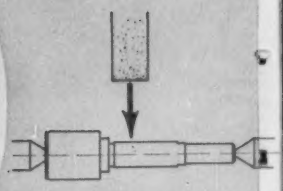
COMPANY

SPRINGFIELD 7, MASSACHUSETTS

For more information fill in page number on Inquiry Card, on page 231

Landis automatic cycle cuts

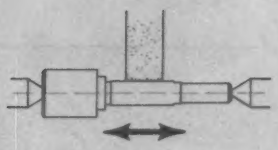




1 Operator moves infeed lever. Wheel head moves rapidly to grinding position by hydraulic power. Work rotation and coolant flow begin.

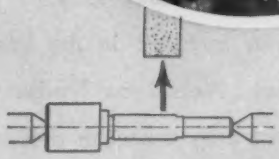
Landis 4" x 18" Type H Plain Cylindrical Grinder with extra cost semi-automatic cycle. Write for catalog A-54.

unit grinding costs up to 50%



2 Hydraulic slow grinding feed and hydraulic traverse operate automatically. Operator changes dogs on workpieces during grinding period.

3 Wheel automatically moves back after work has been ground to pre-set size. Coolant stops and infeed lever re-sets.

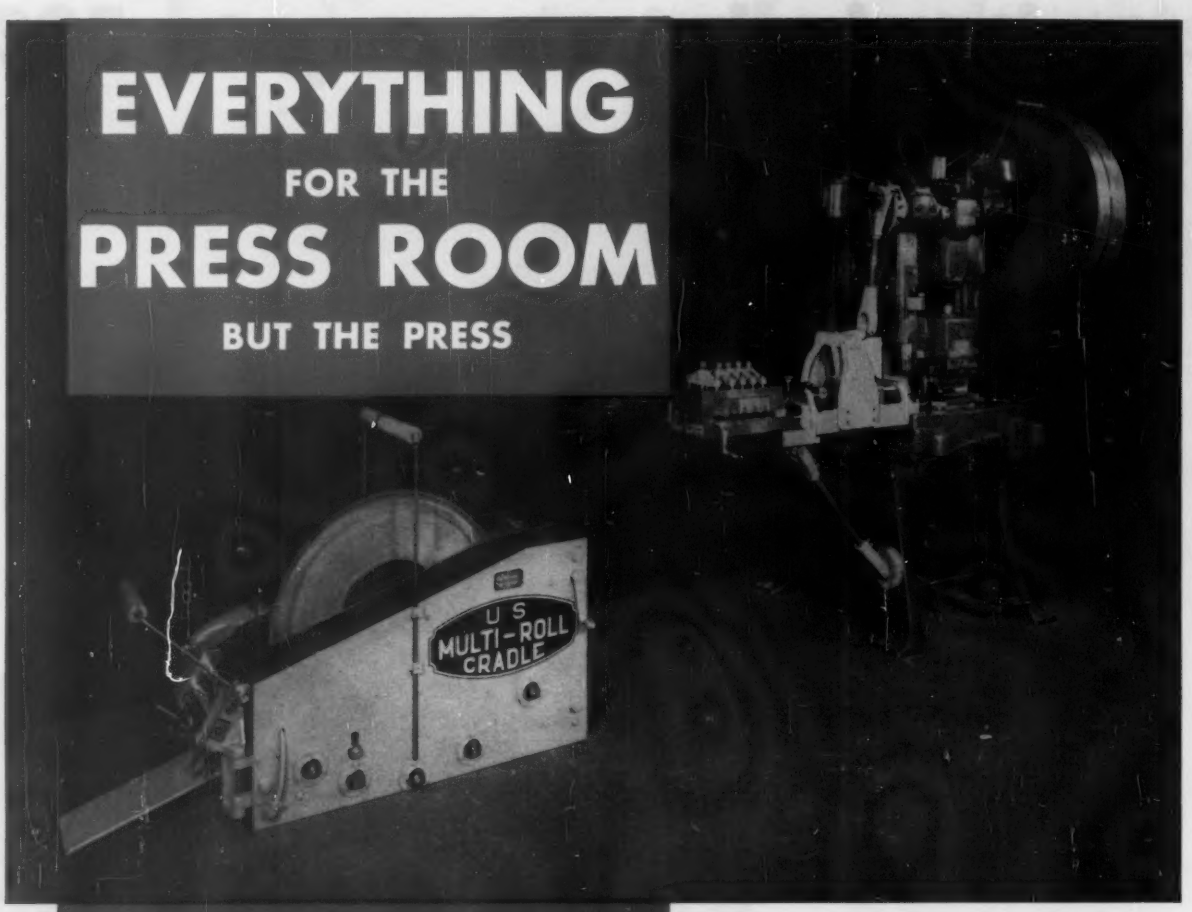


4 Operator moves footstock lever to unload and load workpieces. Cycle ready to repeat.

LANDIS
precision grinders

LANDIS TOOL COMPANY
WAYNESBORO, PENNSYLVANIA

EVERYTHING
FOR THE
PRESS ROOM
BUT THE PRESS



If you are interested in reducing costs in your Press Room, U. S. equipment of the type illustrated may be the answer. The units included in the line of U. S. Automatic Press Room Equipment are designed and built with the aim of converting the punch press into an automatic machine. The end results are increased production, reduced scrap, reduced operator fatigue, reduced material handling and overall reduced costs. This is the goal of all manufacturing concerns. If you use presses in your production process, ask for a copy of Bulletins 80-M and 95-M.

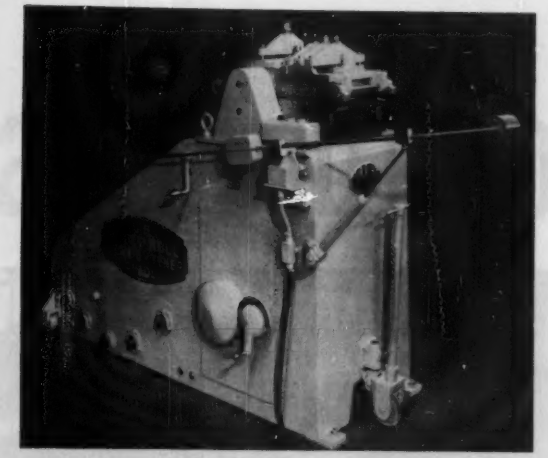
Above: Conventional OBI Punch Press equipped with U. S. Slide Feed with Plain Straightener and U. S. Multi-Roll Cradle.

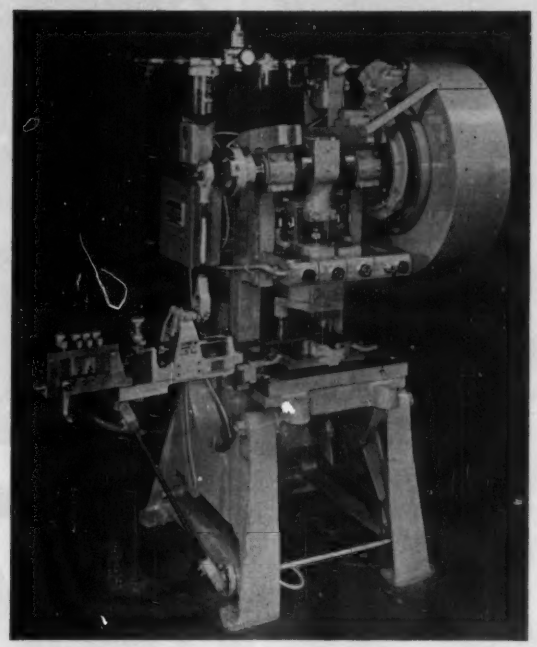
U.S. TOOL

Above right: Model PDSC-940 U. S. Combination Coil Cradle and Power Driven Straightener suitable for material up to 9" in width and coils with O. D. up to 40", weight capacity 1,500 lbs.

Right center: Another OBI Press equipped with U. S. Slide Feed and Plain Straightener.

Right below: U. S. Air Operated Slide Feed (no mechanical connections to the press), open side type, suitable for material up to 15" in width and feeding length adjustable up to a maximum of 12" at one stroke. Longer feed lengths obtainable by cycle feeding with counter.





U. S. SLIDE FEEDS

Mechanically-Driven U. S. Slide Feeds made in a range of sizes up to 24" wide.

U. S. ROLL FEEDS

Made in either single or double types in a range of sizes.

U. S. STOCK STRAIGHTENERS

Made in a range of sizes in both the Plain and Power Driven Types.

U. S. COIL CRADLES

Made in a range of standard sizes up to 24" in width; larger units quoted upon request.

U. S. STOCK REELS

Range of sizes made in Plain, Automatic and Centralizing Types.

U. S. STOCK OILERS AND WIPERS

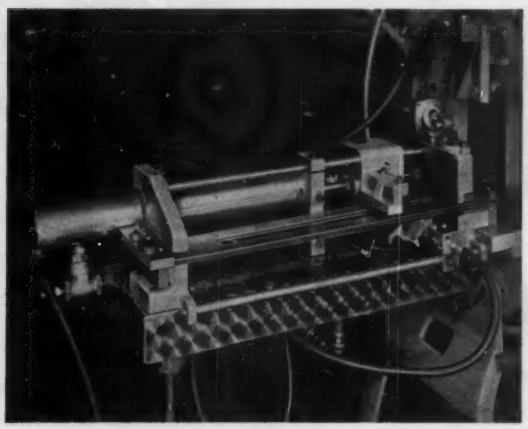
Presently made in three sizes; 8, 12 and 24" width capacity.

U. S. SCRAP CHOPPERS

Made in one size independently Motor-Driven and also Ram or Eccentric-Operated Types for use with Roll Feed setups.

COMPANY, Inc.

AMPERE (East Orange)
NEW JERSEY



Also U. S. MULTI-SLIDES

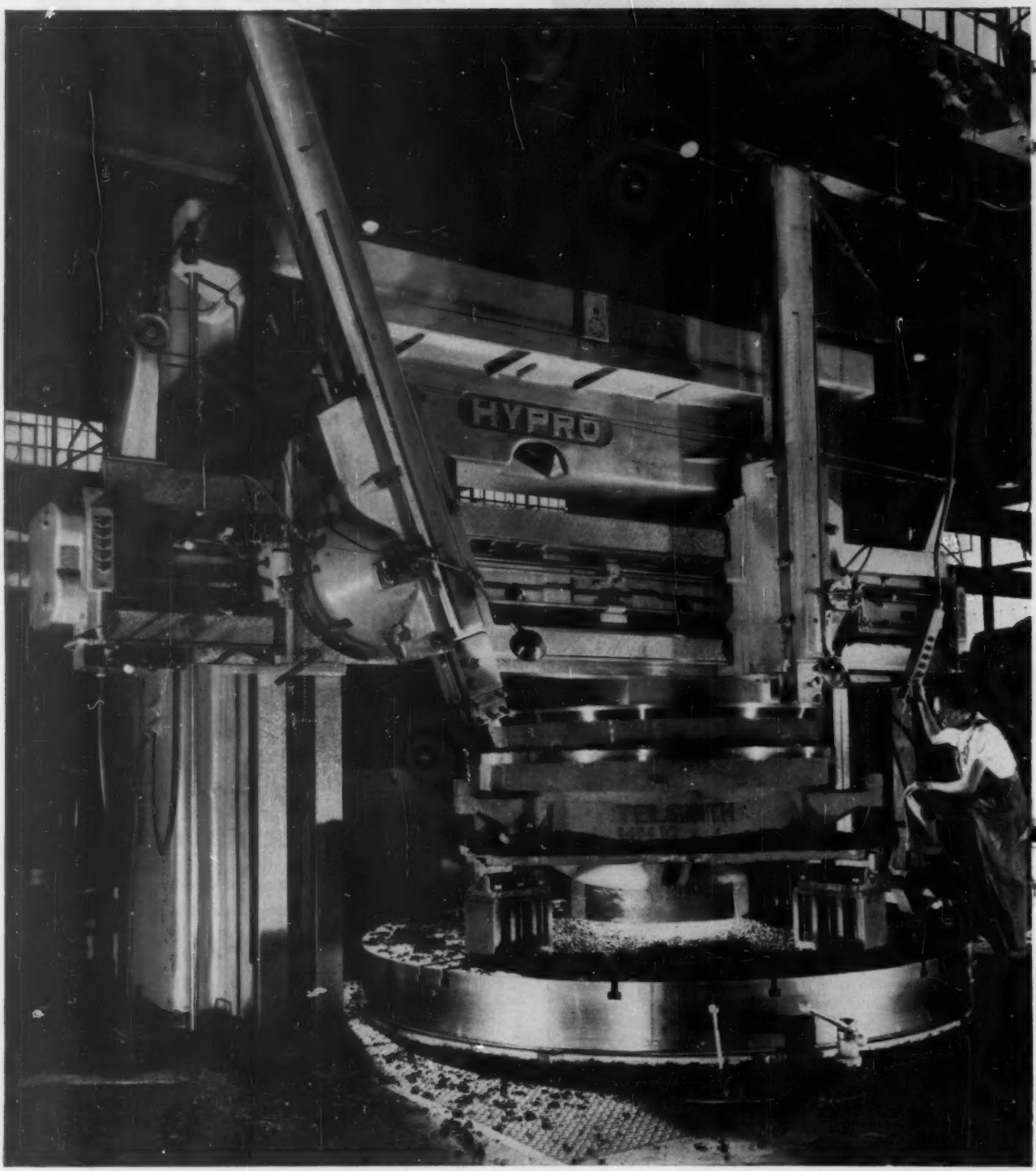
For the automatic high-speed production of precision formed stampings from coil stock, your attention is called to the U. S. Multi-Slide Machine as described and illustrated in Bulletin No. 15-M.

U. S. MULTI-MILLERS

Production horizontal type Milling Machines for the performance of a wide range of milling operations on small and medium sized parts described in Bulletin No. 25-M.

For more information fill in page number on Inquiry Card, on page 231

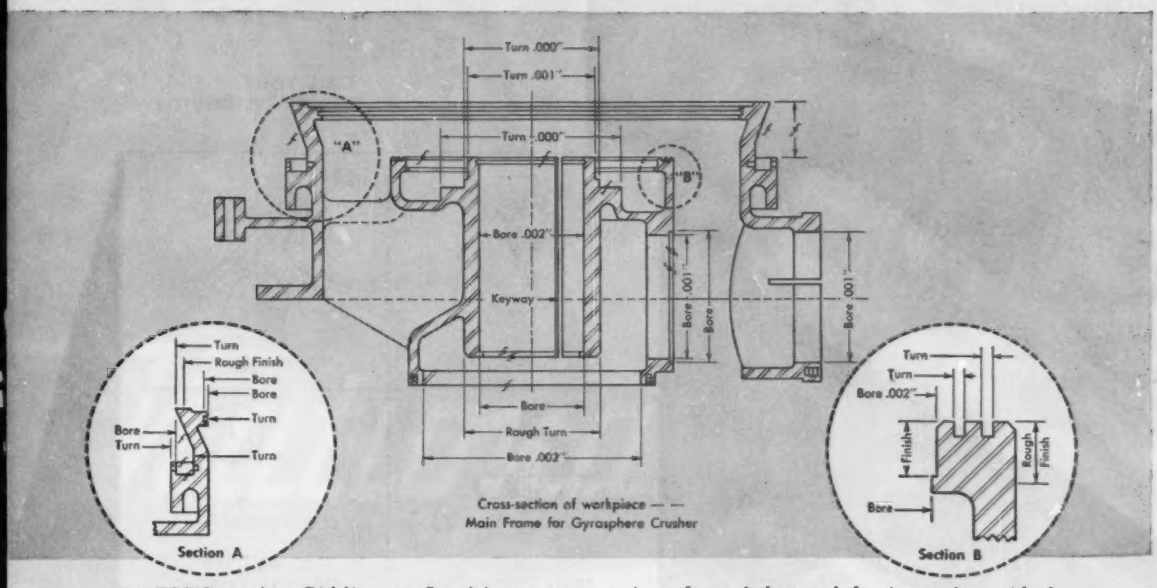
20 precision turning



and boring operations

.000" to -.002" tolerances

That's what Smith Engineering gets with a Giddings & Lewis 10-ft. Hypro Vertical Mill, machining 5½-ton, all-steel Gyrasphere main crusher frames



Cross-section of workpiece — — Main Frame for Gyrosphere Crusher

HERE'S another Giddings & Lewis' masterpiece of precision in action. It's a 10-ft. Hypro Vertical Boring and Turning mill that's on the job every day at the Smith Engineering Works, Milwaukee. Extremely versatile and accurate, this boring mill turns and bores 20 different diameters on the hi-carbon, cast-steel main crusher frame — 7-ft. wide, 3'4½" high, weighing 5½ tons. Inside and outside diameters at different height are machined to precise tolerances — .000" to −.002".

There's a good reason for this kind of precision performance. You'll find it in G&L's advanced design and operating features, such as non-metallic ram and saddle bearings that resist abrasive action of metal dust and forging scale, residual heat, etc. No more chatter, cutter breakage and vibration so harmful to precision machining.

G&L Hypro Vertical Boring and Turning mills are available with an electronic tracer control system, plus a wide range of optional operating features. They're built in 12 standard models with capacities ranging from 54" to 12'.

Remember, if you're considering buying a new vertical boring mill, it will be profitable for you to get in touch with your G&L representative today, or write direct to factory.

Write for this 42-page catalog, describing and illustrating G&L's broad line of Hypro Vertical mills. Ask for Catalog No. 54-12.

G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

G-62

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Machines.

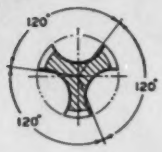
WINTER

TO GET TAPPED HOLES AT MINIMUM COST...

...be sure the taps you use are skillfully designed and painstakingly manufactured. Cost-comparisons are always favorable to Winter Taps—the only taps with built-in BALANCED ACTION.

Winter Gages, plug and ring, thread and plain are made with "Balanced Action" accuracy.

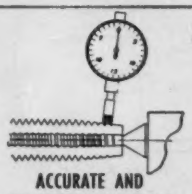
CALL YOUR WINTER DISTRIBUTOR



EXACT FLUTE SPACING

UNIFORM FLUTE CONTOURS

PRECISION CHIP DRIVER CONTOURS



ACCURATE AND CONCENTRIC CHAMFERS

WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A. — Distributors in principal cities. Branches in New York · Detroit · Cleveland · Chicago · Dallas · San Francisco · Los Angeles · Division of National Twist Drill and Tool Co.

National

NATIONAL TWIST DRILL & TOOL
ROCHESTER, MICH. U.S.A.

WHEN A NATIONAL TOOL

BITES INTO YOUR METAL...

...its sturdy cutting edges are saving you money in accuracy, minimum scrap loss and long tool life. It pays to standardize on National Tools for your reaming, counterboring and spotfacing operations.

CALL YOUR NATIONAL DISTRIBUTOR

NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U.S.A., Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles

America's oldest, leading shear

the most in accuracy, speed

NIAGARA

POWER SQUARING SHEARS

builder offers you

and thrifty performance

One of the greatest values of a Niagara Power Squaring Shear is the unequaled experience of its builder. Niagara has been making shears for more than three quarters of a century.

Today, as in the past, the oldest leading name in shears stands also for the most modern in shear design. Niagara has continually set the pace in offering the most of **things which count the most** in dependable shear performance.

YOU GET THE MOST IN ACCURACY:

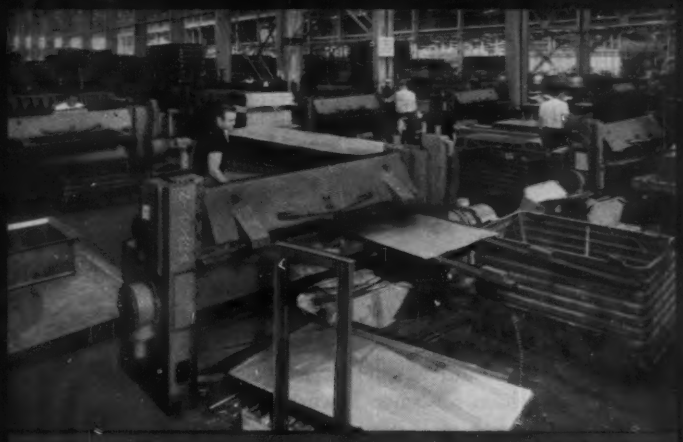
- With the cutting line fully visible, the positive power actuated, self-compensating holddown grips work securely. Multiple pressure feet on 6" centers apply uniform pressure, contacting the work with low impact to safeguard material and bed against damage. Long or short work is held tight against the bed. There's no rippling of the sheet as the keen edged, low-sloped upper knife shears through . . . clean and smooth.
- Niagara's fully closed box section construction of bed, crosshead, holddown and housings plus ample and accurately held crosshead guides resist horizontal, vertical and torsional stresses with minimum deflection.
- Edges are trimmed straight and true within micrometer tolerances. Blanks, too, are cut accurately to size and shape without making compensating allowances when setting gages. Only a Niagara Shear possesses **all** of the necessary features to insure maximum accuracy!

YOU GET THE MOST IN SPEED:

- More working strokes delivered per minute and instant engagement of the Niagara Sleeve Clutch assure more cuts per hour. In continuous feed shearing, quick release of the power driven holddown enables a strip to be cut at each stroke.
- There's no need to adjust knife clearance every time a different thickness of stock is cut. Individual holddown feet are self-compensating. Two sheets of different thicknesses can be cut at the same time with the same knife adjustment and with the same accuracy.
- Ease of operation, quick setting gages and confidence inspired by safety features further increase hourly output . . . and make a Niagara Shear a truly productive, profitable investment for you!

YOU GET THE MOST IN THRIFTY PERFORMANCE:

- Simplicity of design, involving a minimum number of parts, cuts out costly maintenance. With less to go wrong, there's less to repair and replace.
- Vital parts of Niagara's driving mechanism (clutch, gearing, flywheel, eccentrics and detent) operate in enclosed oil-tight cases. Ideal lubrication and maximum safety are thus insured.
- With power transmitted from the drive through efficient spur gears and Niagara's instant engaging, multiple-point sleeve clutch, there are no sliding surfaces (such as in worm gears and friction clutches) to consume power, generate heat and wear rapidly.
- Niagara 4-cutting-edge knives, manufactured entirely within the Niagara plant, are uniformly tough to withstand hard usage and are promptly available.



Niagara Shears at work in Ohio plant of one of the major electrical appliance manufacturers.

MOST EXACTLY SUITED TO YOUR NEEDS, TOO!

To fit your requirements exactly, consult a Niagara representative. With over 7 dozen models available in capacities from shim stock to 1" mild steel and in cutting lengths from 3 to 24 ft., he'll be able to recommend the shear that's **right** for you.

ILLUSTRATED, FACT-FILLED BULLETIN 69 MAILED FREE ON REQUEST

It will give you detailed information on the complete, modern line of Niagara Underdrive Squaring Shears. Write for your copy today.

NIAGARA MACHINE & TOOL WORKS, BUFFALO 11, N.Y.

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BUFFALO • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA

Dealers in principal U. S. cities and major foreign countries

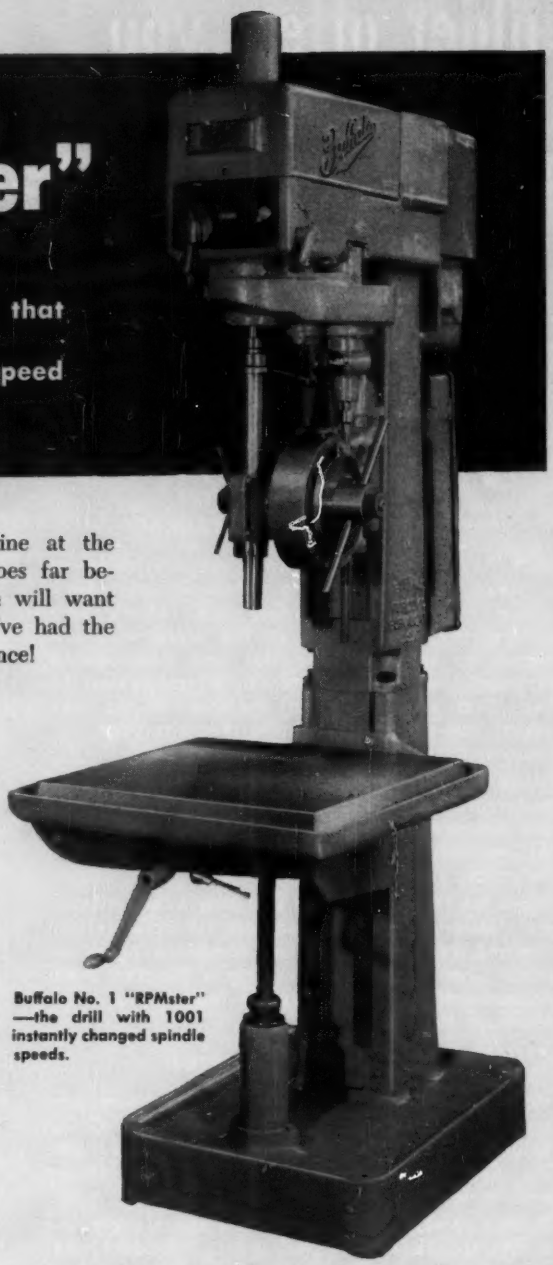
America's Most Complete Line of Presses, Shears, Press Brakes, Other Machines and Tools for Plate and Sheet Metal Work.

You Have to Operate

THE NEW "RPMster"

to Believe It!

- . . . So perfectly balanced and fitted that it's vibrationless!
- . . . So smooth in feed and spindle speed adjustment!
- . . . So responsive to your commands!



Buffalo No. 1 "RPMster" —the drill with 1001 instantly changed spindle speeds.

Those who saw this great new drilling machine at the NMTBA Show will verify it. The "RPMster" goes far beyond the ordinary concept of a "drillpress". You will want to have one or more working for you, after you've had the experience of operating one—and it is an experience!

First, its gearless drive and perfectly fitted spindle provide extreme smoothness and quietness of operation.

Second, you can instantly get any low range spindle speed from 100 to 550 R.P.M.s at the touch of a lever—and, by switching to high range in a few seconds, any speed from 500 to 3000 R.P.M.s. Here is the really versatile machine for smooth work flow through the wide range of drilling, reaming and tapping operations.

And as the "Buffalo" power feed obeys your touch, you know you're completely in command of this powerful 88" high machine. The "RPMster" lives up in every way to the "Buffalo" "Q" Factor* standard of performance.

Your nearby "Buffalo" representative will be glad to arrange a demonstration, or write us.

***The "Q" Factor—the built-in Quality which provides trouble-free satisfaction and long life.**

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

BUFFALO FORGE COMPANY

440 BROADWAY BUFFALO, NEW YORK

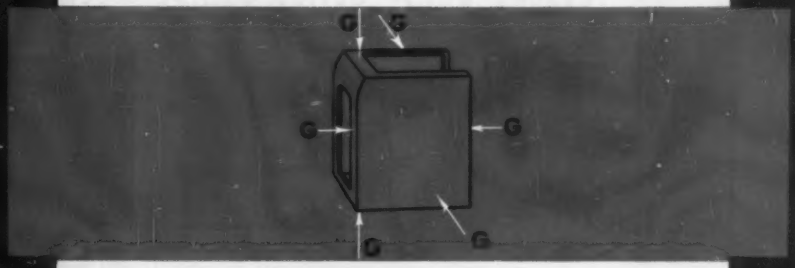
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING • PUNCHING • SHEARING • BENDING

For more information fill in page number on Inquiry Card, on page 231

How disc life was increased from 5 days to 5 weeks

This production improvement on coin box grinding results directly from combined recommendations of *both* Gardner Machine Representative and Gardner Abrasives Specialist . . .



Gardner #124-53" horizontal disc grinder for continuous grinding of coin box surfaces.

Here's what was done:

1. Disc specification revised
2. Dressing method changed
3. Minor adjustment in fixturing

For practical solutions to your disc grinding problems call Gardner for complete service.

GARDNER

abrasive discs

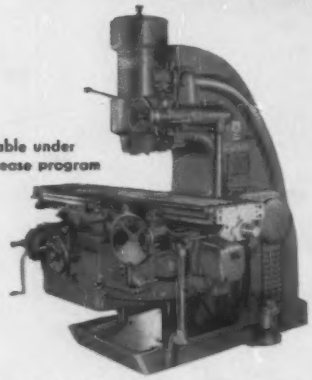
BELOIT, WISCONSIN

Now Kearney & Trecker has

TF Series milling machines — front-mounted for faster table settings... positioned to prevent costly errors

Standard equipment on new

Available under Tool-Lease program



TF Series Model 550 Vertical Milling Machine

POWER — 50/25 spindle drive; 5hp feed and rapid traverse drive
TABLE WORKING SURFACE — 96" x 18"
FEEDS — (32) 3/8" to 90"
SPEEDS — (16) single-speed, (32) two-speed
WEIGHT — 17,600 lbs.

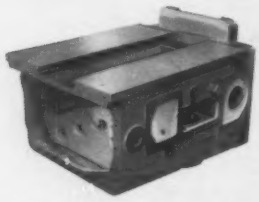
THE front-mounted table handwheel is a standard feature on all Kearney & Trecker new TF Series, knee-type milling machines — Plain, Universal and Vertical. Mounted on the right front of the saddle and projecting diagonally, the newly positioned handwheel is a part of Kearney & Trecker's up-front central control grouping.

Because the handwheel is ideally located so as to simplify operation of the machine, the operator makes table settings more accurately — in less time and without leaving his normal operating position. It measurably reduces operator fatigue.

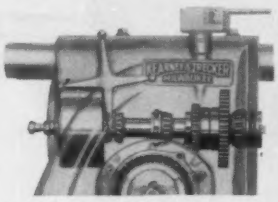
In addition, the new TF's give you a combination of more outstanding design and operating features (illustrated below) than any other knee-type milling machine on the market today. They're available in five sizes — No. 2 to No. 6 from 10hp to 50hp.

For complete specifications, and what these TF's can do for you, see your nearest Kearney & Trecker representative, or write direct to Kearney & Trecker Corp., Milwaukee 14, Wisconsin.

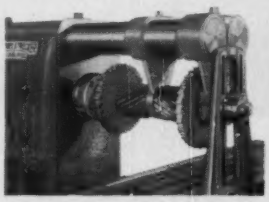
5 more reasons why TF Series milling machines are so easy to operate



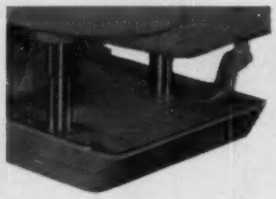
Heavier, Wider, One-Piece Knee — The *Twin Screw* arrangement supports the heavier, larger knee. Span and length of ways is increased considerably, providing fuller saddle support . . . longer-lasting accuracy.



Three-Bearing Spindle — Complete assembly consists of three heavy-duty bearings, fly-wheel, train of wide-faced forged steel gears. Rigidity of spindle unit contributes to increased cutter life and quieter operation.



Double "Vibra-Void" Overarms — Two solid steel bars, mounted completely through column, void vibration at source, afford more rigidity and resistance to deflection. Design also greatly simplifies changing of arbors and cutters.



Twin Screw Knee Support — Exclusive double-support arrangement most effectively distributes weight of the new machines' much larger, wider, heavier knee, saddle and table. This balanced design substantially increases stability under heaviest loads . . . offers greater resistance to torsional thrust under all cuts . . . halves the wear factor, assuring greater, longer-lasting accuracy.

Massive Column — Solid back, double-box section column is scientifically ribbed throughout to rigidly withstand heaviest cutting forces. Full bearing column face affords maximum support for the knee. Cross-mounted motor assures maximum ventilation, easy access for routine maintenance.

KEARNEY & TRECKER CORP.
6788 W. National Ave., Milwaukee 14, Wisconsin

Please send me Catalog No. TF-50 with details on the new line of TF Series Plain, Universal and Vertical milling machines.

Name.....

Title.....

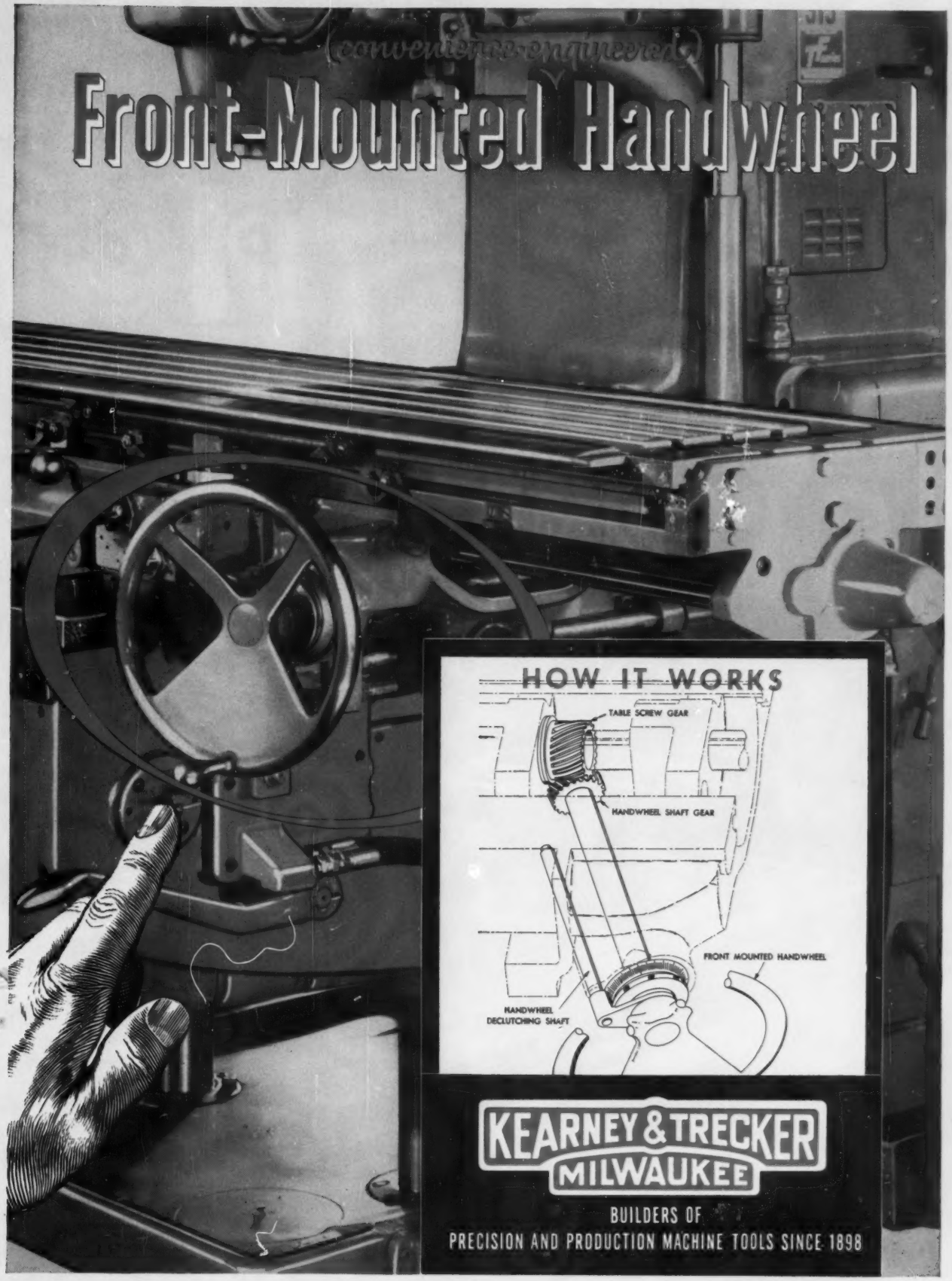
Company.....

Address.....

City.....Zone.....State.....

(convenience-engineered)

Front-Mounted Handwheel



HOW IT WORKS

KEARNEY & TRECKER
MILWAUKEE

BUILDERS OF
PRECISION AND PRODUCTION MACHINE TOOLS SINCE 1898

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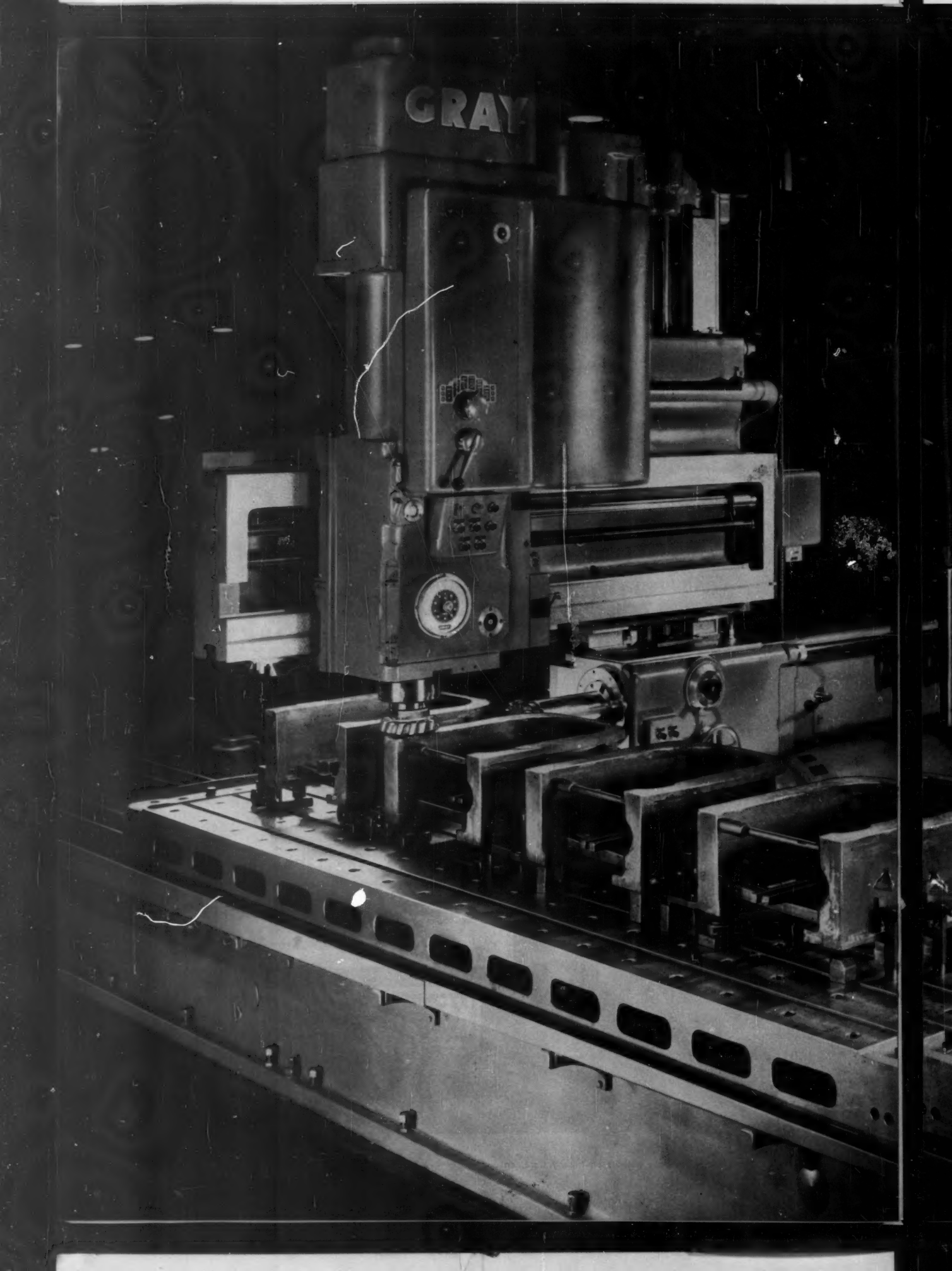
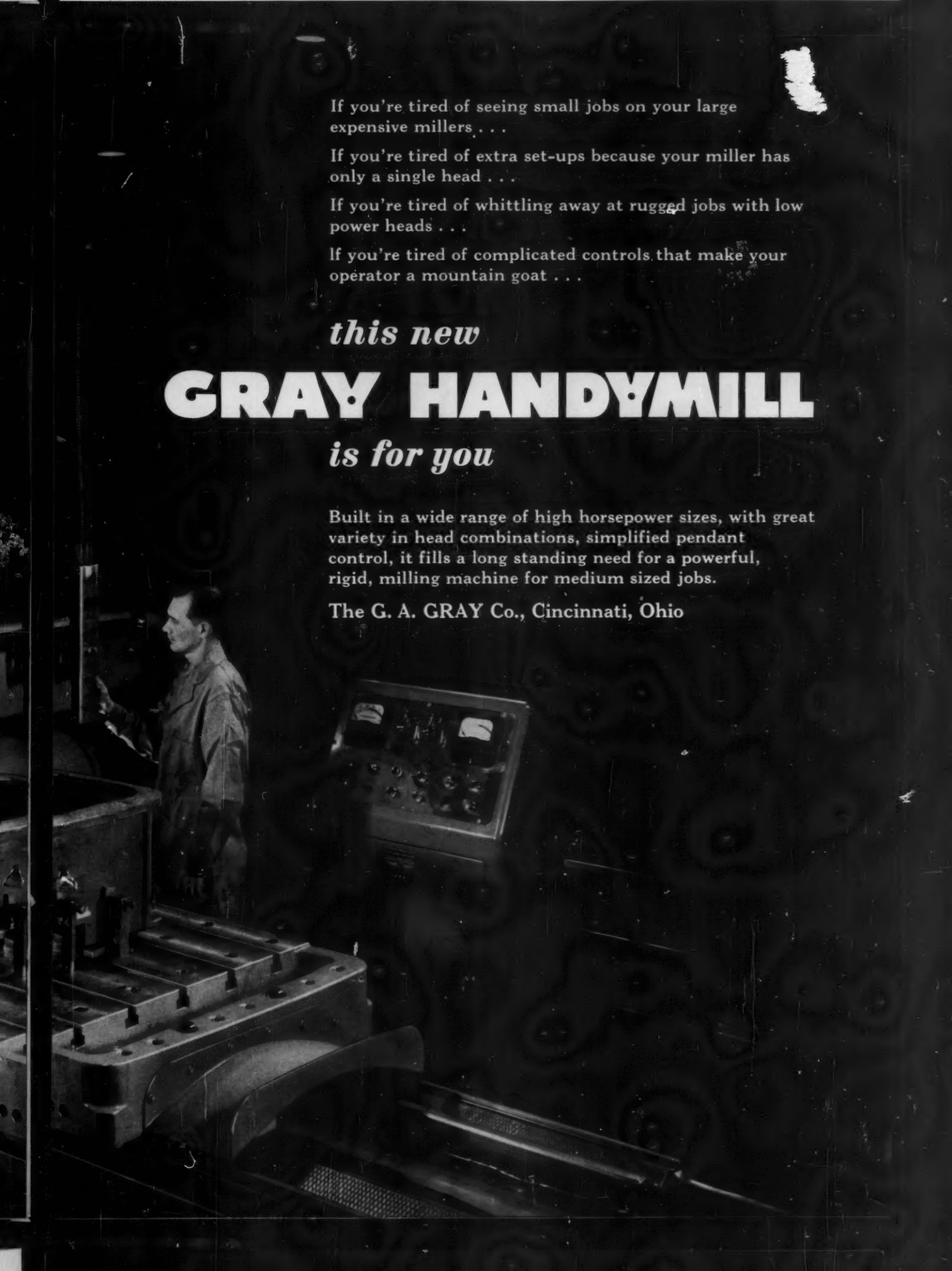
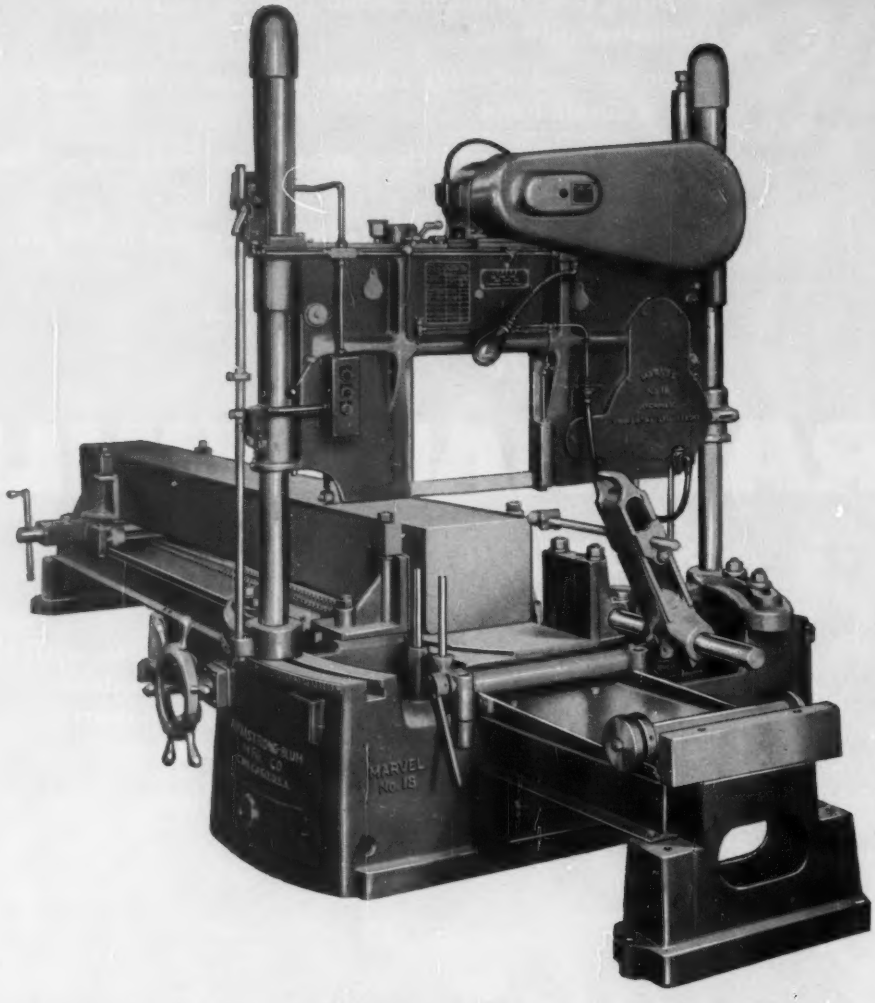

GRAY


If you're tired of seeing small jobs on your large expensive millers . . .
If you're tired of extra set-ups because your miller has only a single head . . .
If you're tired of whittling away at rugged jobs with low power heads . . .
If you're tired of complicated controls that make your operator a mountain goat . . .
this new
GRAY HANDYMILL
is for you
Built in a wide range of high horsepower sizes, with great variety in head combinations, simplified pendant control, it fills a long standing need for a powerful, rigid, milling machine for medium sized jobs.
The G. A. GRAY Co., Cincinnati, Ohio



No Job too big or too tough . . .

for MARVEL "*Giant*" Hack Saws

These giant MARVEL Hydraulic Hack Saws (No. 18, Capacity 18" x 18"; and No. 24, Capacity 24" x 24") were *basically* designed for rapid and economical cut-off of BIG WORK. They are not merely "conventional" designs "stretched" to big capacity. They are truly designed and built with the ruggedness and rigidity necessary to withstand the rough treatment of sawing big work, even though the work is in the "toughest of the tough" alloys.

They are reliably fulfilling the cut-off requirements in innumerable steel mills, forge shops, structural shops, warehouses, and machine shops, with assured low tool cost and minimum kerf loss of steel.

In addition to cutting-off, they are reducing costs by eliminating further machining operations. Heat treated die blocks are being reclaimed for re-sinking by sawing off the worn face; columns, beams, pipe, and tubing are being sawed to *finished*, square ends, eliminating milling; angular sawing is done conveniently by swinging the upper structure on the base, to any angle up to 45 degrees—*without moving the work*.

Contemplating the modern trend toward ever tougher steels and larger sizes, these are the logical sawing machines to buy, not only for today's needs but for tomorrow's as well.

Write for Catalog

MARVEL *Metal Cutting* SAWS
Better Machines–Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.

For more information fill in page number on Inquiry Card, on page 231

COLD FACTS about the HOTTEST IDEA in the history of coolants...

1 **CIMCOOL**° Concentrate has become, in just a few years, the largest selling chemical cutting fluid in the world.

2 **CIMCOOL LOWERS COSTS** because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.

3 **CIMCOOL DOES A BETTER JOB** because of its chemical lubricity. It permits faster speeds and feeds, for it combines friction reduction and cooling capacity in a degree never before attained by old-fashioned coolants.

4 **CIMCOOL IS CLEAN,** doesn't soil hands or clothing. It contains no skin irritants. It leaves no slippery film on shoes, floors, machine or work. It can't smoke, can't burn, and virtually eliminates rancidity and foul odors.

For complete details on all the advantages of CIMCOOL Standard Concentrate, consult your CIMCOOL distributor. He'll be happy to tell you all about CIMCOOL—as well as the entire family of CIMCOOL Cutting Fluids. Or contact us direct and we'll send one of our Cincinnati Milling-trained machinists to call on you—without cost or obligation. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

CIMCOOL CUTTING FLUIDS

CIMCOOL Concentrate—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL Tapping Compound—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT Base Additive — For jobs requiring an oil-base cutting fluid. Added to mineral oils, it gives an economical mix for higher speeds and feeds.

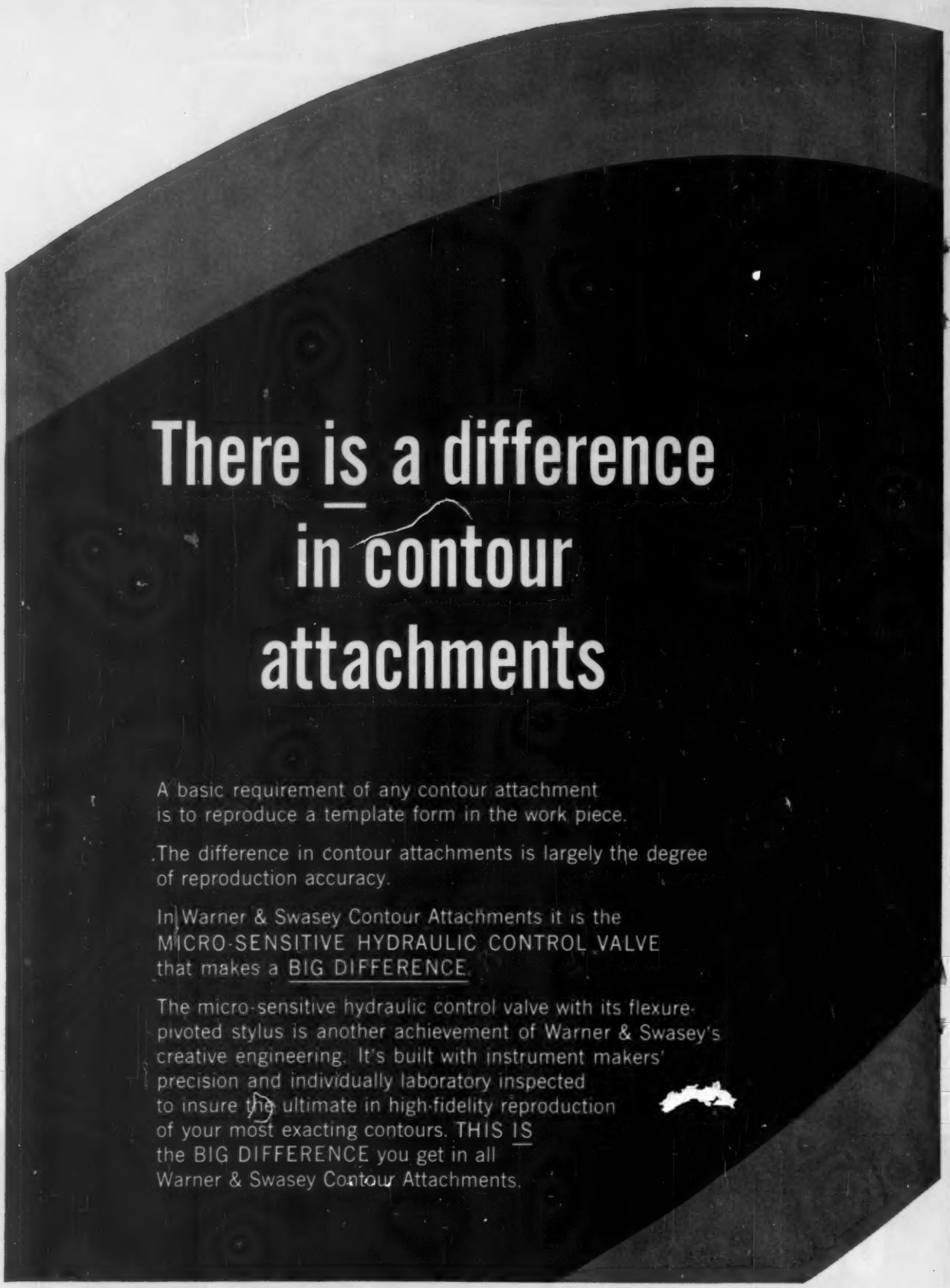
CIMCOOL Bactericide — The most effective agent yet developed to overcome rancidity and foul odors.

CIMCOOL Machine Cleaner — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

CIMCOOL Cutting Fluids

for 100% of all metal cutting jobs

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

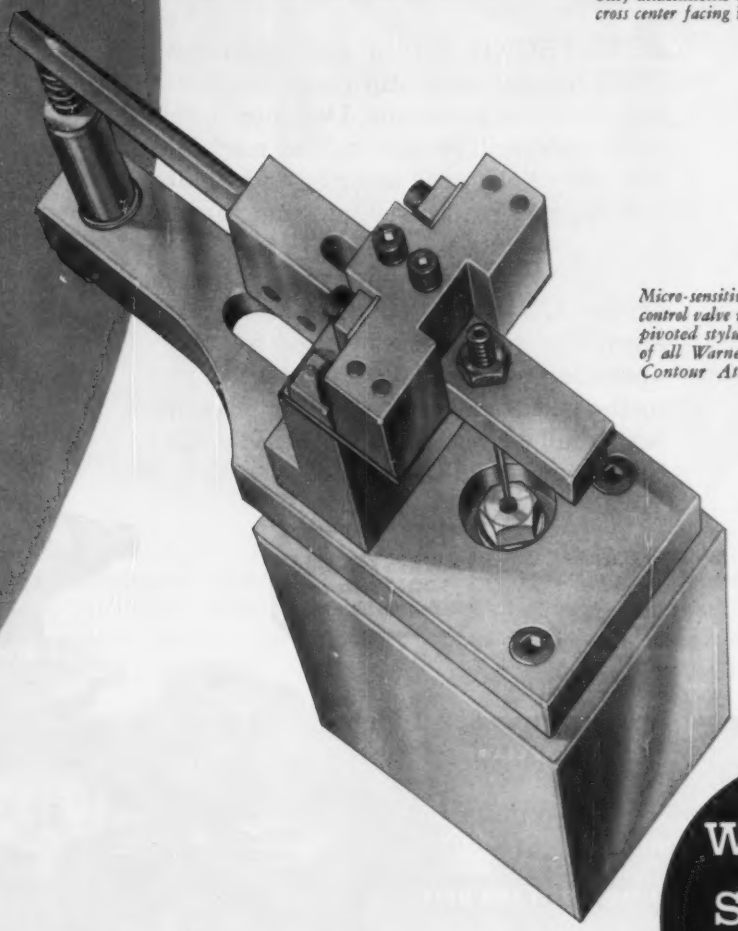

There is a difference
in contour
attachments
A basic requirement of any contour attachment is to reproduce a template form in the work piece.
The difference in contour attachments is largely the degree of reproduction accuracy.
In Warner & Swasey Contour Attachments it is the MICRO-SENSITIVE HYDRAULIC CONTROL VALVE that makes a BIG DIFFERENCE.
The micro-sensitive hydraulic control valve with its flexure-pivoted stylus is another achievement of Warner & Swasey's creative engineering. It's built with instrument makers' precision and individually laboratory inspected to insure the ultimate in high-fidelity reproduction of your most exacting contours. THIS IS the BIG DIFFERENCE you get in all Warner & Swasey Contour Attachments.

Available on Warner & Swasey 3-A and 4-A Saddle Type Turret Lathes.

NEW WARNER & SWASEY HEXAGON TURRET CONTOURING SLIDE TOOLS—Exclusively designed for contour boring work.

Available on No. 5 Ram Type and 2-A, 3-A and 4-A Saddle Type Turret Lathes.

WARNER & SWASEY CROSS SLIDE CONTOUR ATTACHMENTS—The only turret lathe contour units that give you *cross center facing*. Also, the only attachments that give you both *turning* and *cross center facing* in one unit.



Micro-sensitive hydraulic control valve with flexure-pivoted stylus—the heart of all Warner & Swasey Contour Attachments.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...

WITH A WARNER & SWASEY

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

ARMSTRONG

T-SLOT CLAMP

SET-UP AND HOLD-DOWN TOOLS

STEP BLOCK

ARMSTRONG Set-up and Hold-down Tools reduce setting-up time—keep men and machines producing. Designed for use on planers, drill presses, milling machines, etc., they hold work securely and rigidly, and thereby reduce spoilage and prevent costly accidents.

Your local Armstrong Distributor carries ARMSTRONG Set-up and Hold-down Tools in stock in sizes for every operation. Stop haphazard setting-up methods. Provide each of your machines with a full complement of ARMSTRONG Set-up and Hold-down Tools.

NON-SKID JACKS

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Buy ARMSTRONG TOOLS from your Industrial Distributor

PLANER JACKS

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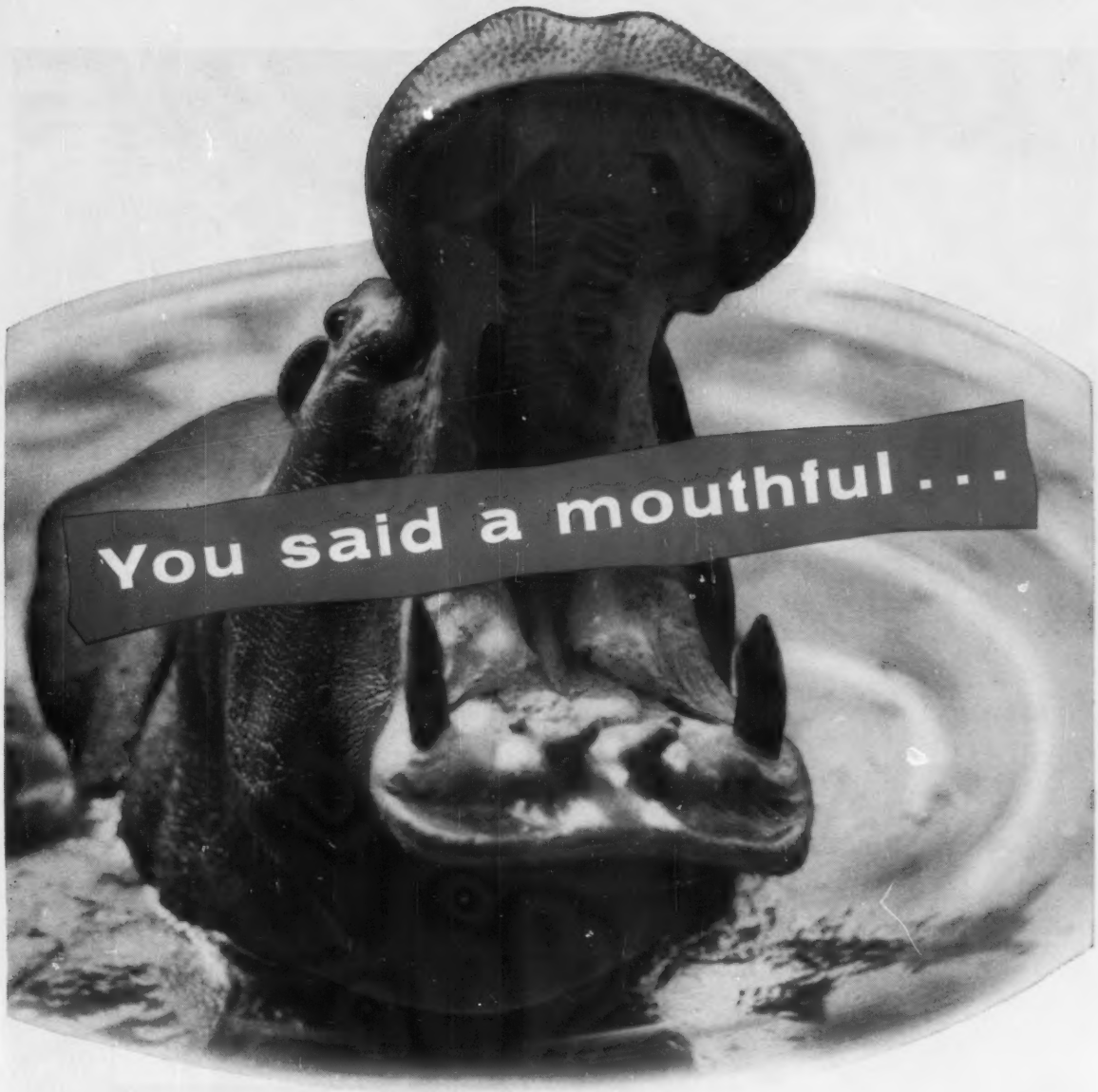
T-SLOT BOLTS AND NUTS

STRAP CLAMPS

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5213 W. ARMSTRONG AVE. CHICAGO 30, U. S. A.



. . . "*Positive Duplication—offered* ONLY *by* CINCINNATI (PD)° GRINDING WHEELS—*is a remarkable achievement in precision manufacturing and quality control!*"

And no wonder everybody's shouting the praises of CINCINNATI (PD) WHEELS. *You can save money . . . and increase your production . . .* when (PD) WHEELS are on the job. For through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS are priced no higher than ordinary wheels.

For complete details, see your CINCINNATI (PD) Grinding Wheels distributor, or contact us direct. We'll be happy to send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Telephone (or wire or write) Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

Remember—*only* CINCINNATI Grinding Wheels give you . . . (PD) POSITIVE DUPLICATION

CINCINNATI° *Grinding Wheels*

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

°Trade Mark Reg. U. S. Pat. Off.

For more information fill in page number on Inquiry Card, on page 231

"BEST BY ANY TURNING TEST"
in the toolroom and on the production line.
Write to Dept. 710 for complete information
and performance data.

Jones & Lamson turret lathes are BUILT and POWERED TO PRODUCE

MORE CHIPS per tool
MORE PIECES per hour
MORE PROFIT per job . . . than any turret lathe of comparable size!

JONES & LAMSON

the man who needs a new machine tool is already paying for it

JONES & LAMSON MACHINE COMPANY, 512 Clinton St., Springfield, Vt., U.S.A. J&L MACHINE TOOL DIV.

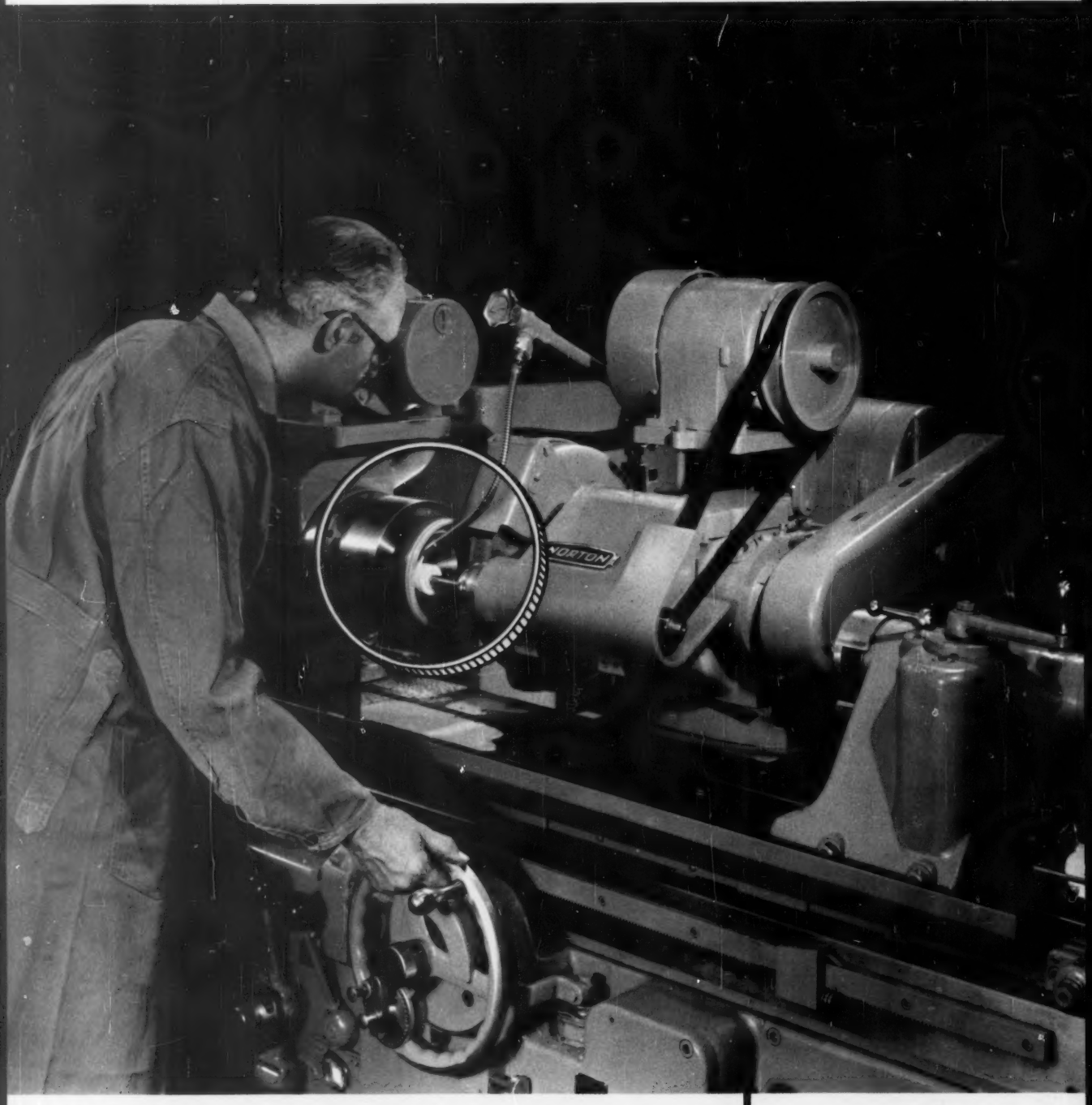
For more information fill in page number on Inquiry Card, on page 231

ANNOUNCING . . .

The New NORTON 14″ and 18″ Type U-4 Universal Grinding Machines

THEY'RE READY!

Two new Norton Type U-4 Universal Grinders



QUICK "GET-AWAY", one of the biggest advantages of the new Norton 14" and 18" Type U-4 universal grinders, shifts the time-and-money-saving "Touch of Gold" from one type of grinding to another — fast. The operator can quickly change over from this internal grinding set-up by swinging the internal grinding spindle assembly up and out of the way. Then he's ready for external, face or angular wheel slide jobs.

NEW SIZES — NEW ADVANCED FEATURES

The popular Norton Type U-4 universal grinders are now built in 14" and 18" capacities. Note optional SWIVALIGN Unit on right of machine.

...14" and 18"...feature extra versatility

...extra fast set-ups...

to bring you extra profits

Now you can get Norton Type U-4 universal grinding machines in 14" and 18" work capacities.

Designed for external, internal, face and angular wheel slide grinding — from rough cuts to finest finishing — the new grinders bring you all the famous Type U-4 features. For example:

Rapid Chucking. The swiveling headstock has a conventional dog drive plate on one end of the spindle for dead-center grinding — plus a 6" D-1 cam lock nose on the other end for mounting chucks or fixtures. You can leave a chuck on the cam lock nose and merely swivel the headstock 180° for real time savings in setting up chucked jobs.

Quick Change-Over of headstock to live or dead spindle operation.

Simple Work Speed Change in a range of 60 to 360 r.p.m. by turning a small hand wheel.

Independent Settings of Wheel and Feed for doing normally difficult jobs fast. The wheel head has swivels above and below the slide ways.

Extra Capacity in Wheel Head. Upper member of the wheel head is easily repositioned for angular slide, face grinding or other operations.

Extra Capacity in Headstock. A 1½" hole clear through the headstock spindle gives additional capacity for grinding long shafts.

Precise Swivel Table Alignment assured by the SWIVALIGN* Dual Electric Indicator, an optional extra.

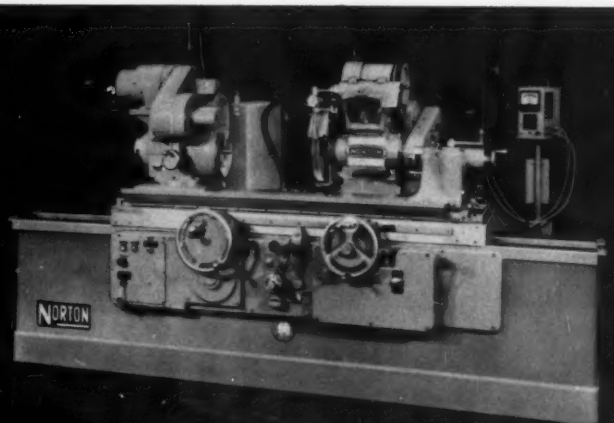
PLUS these new advancements:

- Wide work speed range from AC power source with full horsepower over the entire speed range.
- Steel-tape-type base way guards protect the ways and require no additional floor space.
- Wheel spindle runs in hard bronze bearings which enclose spindle and support over 50% of spindle body.
- Footstock spindle remains in retracted position for loading.

Ask us about them

Be sure you get the whole story on these new Norton grinders. Compare them with your present grinding machines — then figure for yourself the advantages of meeting competition with the best equipment of its type ever built. See your Norton Representative or write us direct. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries



NORTON

Making better products

. . . to make

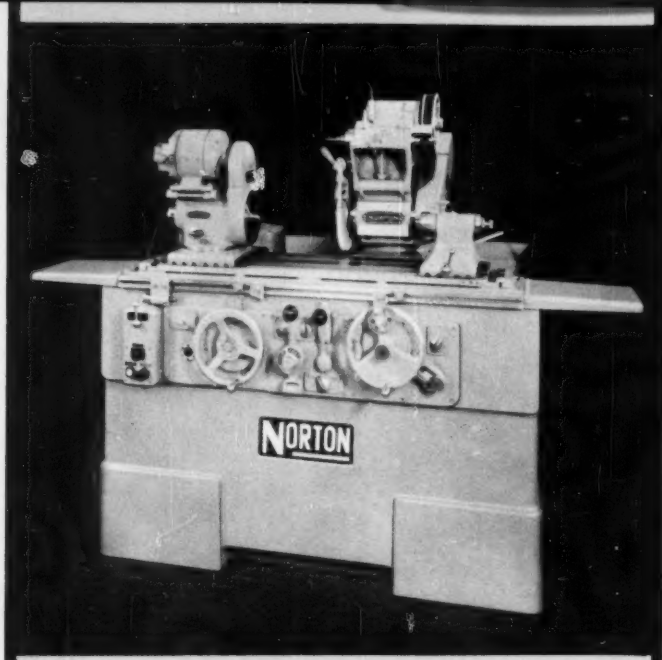
your products better

. . . and now meet two other top performers in the complete line of Norton Universal Grinders

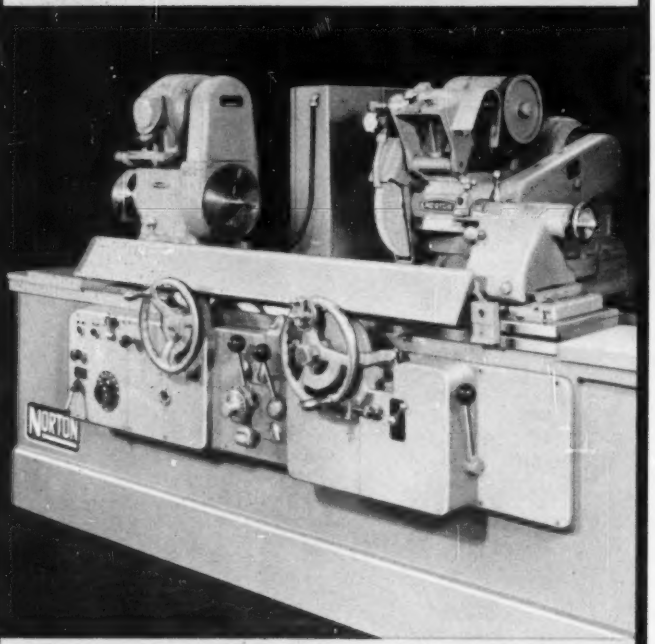
The preceding pages told you about the Norton 14" and 18" Type U-4's — two new additions that complete the Norton line of universal grinders for the broadest range of practical usefulness.

From the smallest 10" machine to the newest, largest 18" Type U-4, Norton universal grinders have one common denominator — top performance.

You can depend on them for speed, versatility and precision accuracy over the widest range of different grinding jobs. And like all Norton grinders and lappers — the world's largest line — they bring you the true "Touch of Gold" — the Norton extra that adds value to your products and cuts your production costs.



Norton 10" Universal Grinder



Norton 12" Universal Grinder, Type U-4

To Economize, Modernize With **NEW**

NORTON

GRINDERS and LAPPERS

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones
Behr-cat Tapes

Printed U. S. A.

District Offices: Worcester • Hartford • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto

up in the clouds...

When a Navy Training Plane points its nose skyward in defiance of gravity, everything from tip to tail must be a model of precision and endurance. Federal Ball Bearings are here, too, in the flexible drive assembly of this Lear actuating screwjack, which helps raise and lower the pilot's seat.

or down the lane!

Bowlers call it magic, the way the AMF Automatic Pinspotter sets 'em up—even replaces "off-spot" pins in their exact location after every roll. Federal Ball Bearings do their part in the gear boxes of these mechanical marvels.

so much of industry *turns* on FEDERAL ball bearings

Pilot's comfort or bowler's score. Production manager's quota or housewife's cake. All are important to those who design and build so many of the thousands of tools, machines and household appliances —with Federal Ball Bearings. 12,000 sizes. Hundreds of types. Produced by this 50-year-old manufacturer of ball bearings, *exclusively.*

When Federal Ball Bearings are part of so many things you *use,* shouldn't they be part of the things you *make?*

Federal

Ball Bearings

One of America's Largest Ball Bearing Manufacturers

THE FEDERAL BEARINGS CO., INC. • POUGHKEEPSIE, N.Y.

New! Ball bearing and engineering data! 175 pages full in FEDERAL'S CATALOG! To get your copy, just drop us a line.

For more information fill in page number on Inquiry Card, on page 231

Expensive parts machined to close tolerances are always in danger of being scratched by jagged chips hiding in the weave of ordinary wiping material. Parts so damaged have to be reworked . . . sometimes scrapped entirely.

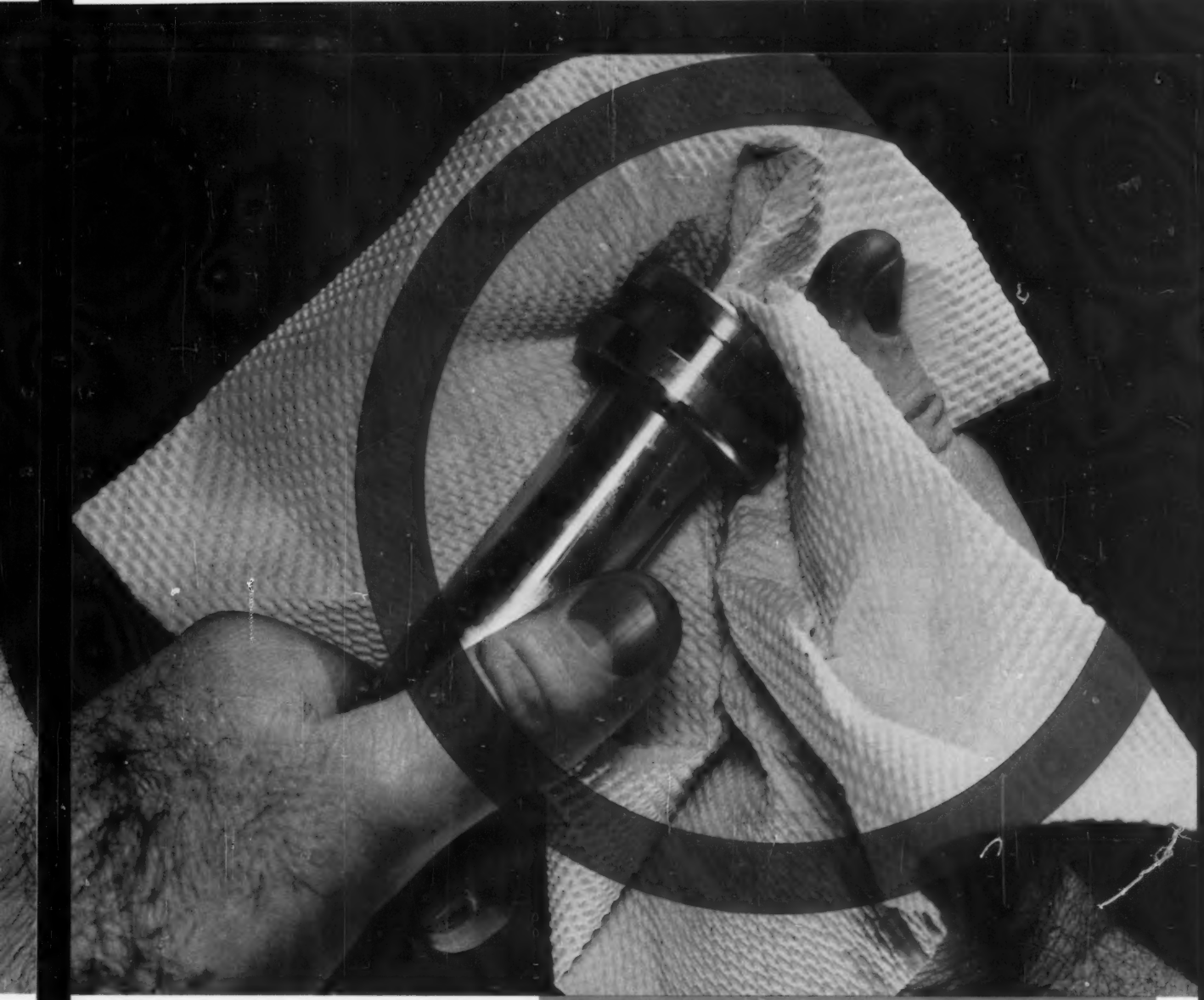
This wiping job could cost $50

Easy to distribute

Really soak up oil . . .

Always a clean one handy . . .

Just toss 'em in the trash . . .



When you use Scott Wipers, chips don't come back to scar men and metal . . . there's always a clean new wiper handy. You use one thoroughly and throw it away. No more expensive collection, sorting, laundering and distribution.

. . . this one cost less than ½¢

The difference is . . . Scott Wipers

Strong, highly absorbent Scott Wipers can be used and re-used. Yet they cost so little you can throw them away after a single use when the job calls for a clean wiper, free of chips and abrasive material.

Scott Wipers are reducing the cost of wiping in many companies. Sorting and baling are eliminated. Handling and distribution are simplified. Laundering becomes a thing of the past.

This is sanitary wiping. A man uses a Scott Wiper thoroughly, throws it away—takes a new one. No danger of cuts from hidden chips . . . no fear of skin infection from dirty wipers.

Your local Scott representative or distributor will demonstrate the Scott Wiper in your plant. Call him or mail this coupon today.

Another quality product of . . .

SCOTT PAPER COMPANY

Scott Paper Company
Dept. W-4, Chester, Pa.

Please send me more information about Scott Wipers.

Name _____

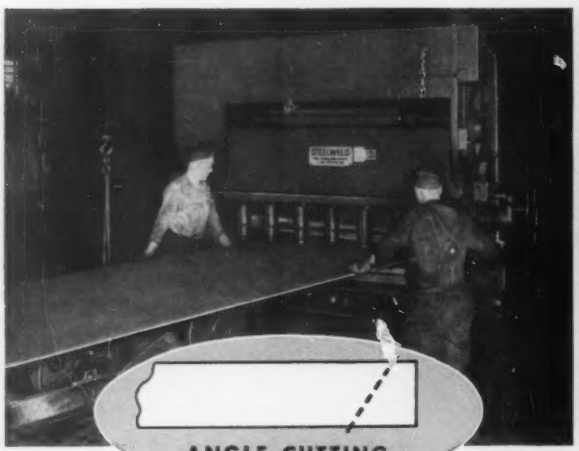
Company _____

Position _____

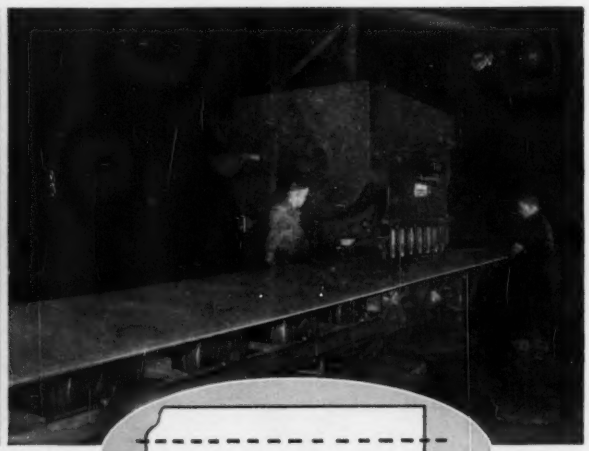
Address _____

Steelweld Shears operate on the widely acclaimed pivoted-blade principle. Shear action is controlled by electric foot switch. Machines for making cuts up to 24'-0" are now in service.

Here's a **VERSATILE SHEAR** that *Speeds Production*



Because of the deep throat in end housings, larger size sheets or plate can be cut at various angles than possible with most shears. This is also a great advantage when notching and slitting.



The standard 24" throat depth permits slitting sheets up to 48" wide on any line. 36" throats are also available for larger machines.

SQUARE or angle cut, slit or notch — any can be made quickly on a Steelweld Shear.

Not only will Steelwelds handle every kind of cut, but they are provided with unusual features that make their operation easier and faster and assure accuracy.

Send for the catalog below. Learn why Steelweld Shears are the most outstanding on the market today.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

5437 East 282 Street, Wickliffe, Ohio

STEELWELD PIVOTED BLADE SHEARS

For more information fill in page number on Inquiry Card, on page 231

Acme-Gridley

fully automatic turret lathe . . . gives you increased production in inverse ratio to cost

This customer chose a model MR Acme-Gridley to produce this packing gland nut, because he was able to increase his production by more than 3 times that of the former method.

The Acme-Gridley automatically controlled cycle is predetermined to give the minimum time per piece, on *every piece*. Because each tool-slide is independently cammed and selective spindle speeds are automatically controlled, machining can be done at the surface speed best suited for required finish and tolerance.

WRITE today for your free copy of new Bulletin MR-56. See why Acme-Gridley Basic Design lets you increase production and lower unit costs.

JOB FACTS

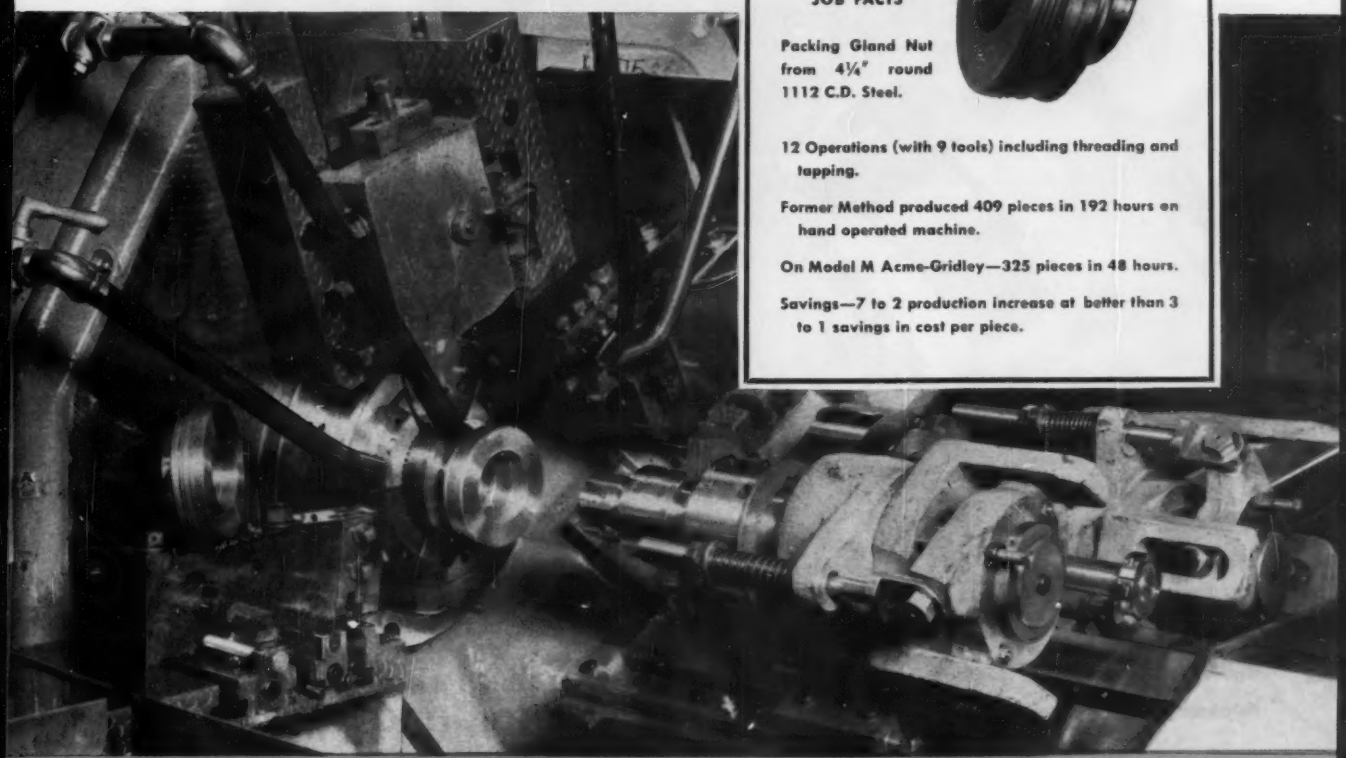
Packing Gland Nut from 4¼" round 1112 C.D. Steel.

12 Operations (with 9 tools) including threading and tapping.

Former Method produced 409 pieces in 192 hours on hand operated machine.

On Model M Acme-Gridley—325 pieces in 48 hours.

Savings—7 to 2 production increase at better than 3 to 1 savings in cost per piece.



National Acme

THE NATIONAL ACME COMPANY, 179 EAST 131ST STREET, CLEVELAND 8, OHIO

ACME-FETTE thread rolling costs are now as low as $0.00005 per piece — see ad on following page →→→

PERFORMANCE FIGURES WITH Acme-FETTE

thread rolling
would look good in any shop!
now look even better!
RIGHT ON SCHEDULE! 4 months and another 1,000,000 pieces later, the original set of rolls are still on the job. Have you taken a close look at your threading picture lately?
THE NATIONAL ACME COMPANY
OUR JOB: to provide the Right Machine for YOUR JOB

Be sure to get Acme-FETTE figures on your threading jobs

THREADING COSTS NOW DOWN TO $0.00005 PER PIECE

National Acme

THE NATIONAL ACME COMPANY, 179 EAST 131ST STREET, CLEVELAND 8, OHIO

←← See — on preceding page — how ACME-GRIDLEY fully automatic turret lathe increases production in inverse ratio to cost

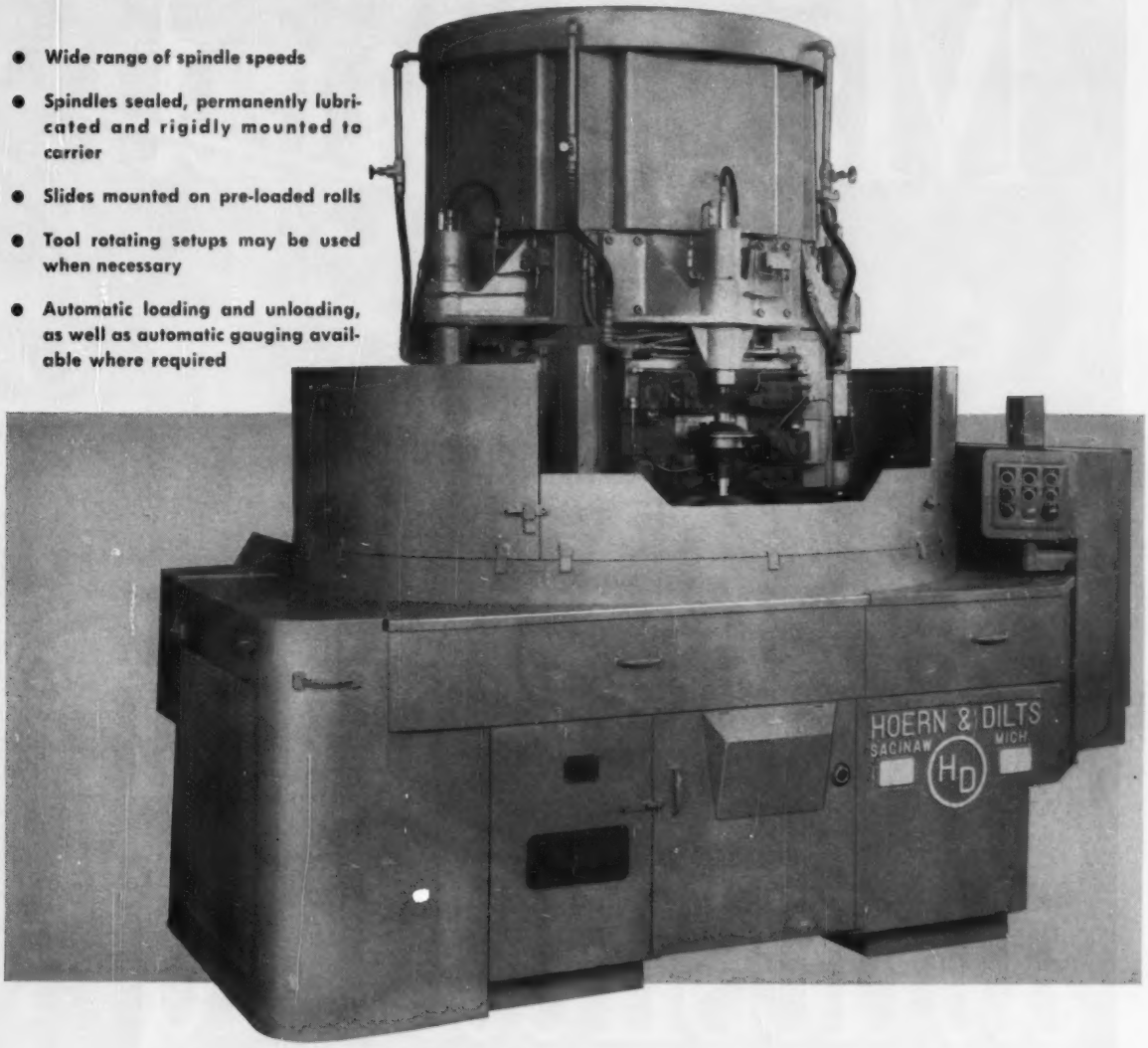
for your precision boring . . . .

5 times as many pieces every hour

Hoern & Dilts continuous boring machines have *five* sets of contour turning and boring slides, each serving one or two spindles and continuously moving around a central column. Slides and spindles travel together. Operator merely loads and unloads.

Pieces are completely turned, bored and faced in one circuit around the machine. One set of stationary cams actuating all slides provides absolute duplication of dimensions between stations.

- **Wide range of spindle speeds**
- **Spindles sealed, permanently lubricated and rigidly mounted to carrier**
- **Slides mounted on pre-loaded rolls**
- **Tool rotating setups may be used when necessary**
- **Automatic loading and unloading, as well as automatic gauging available where required**



Hoern & Dilts engineers will welcome the opportunity to cooperate with you on any high production finishing operation.

HOERN & DILTS DIVISION

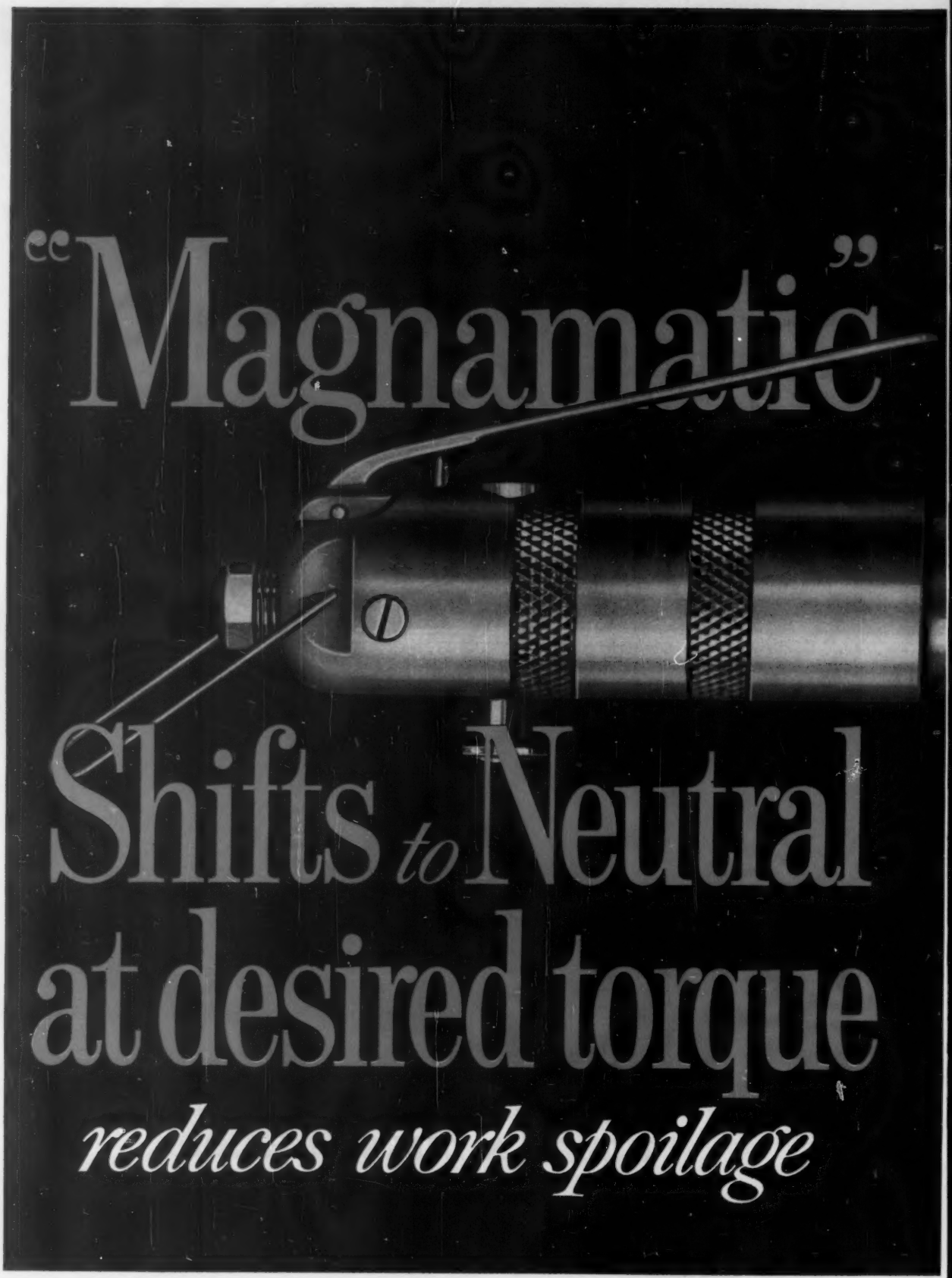
The New Britain Machine Company • Saginaw, Michigan

OTHER NEW BRITAIN MACHINE TOOL DIVISIONS

New Britain-Gridley Machine Division
New Britain, Connecticut
Automatic Bar and Chucking Machines
Precision Boring Machines and New Britain +GF+ Copy Turning Lathes

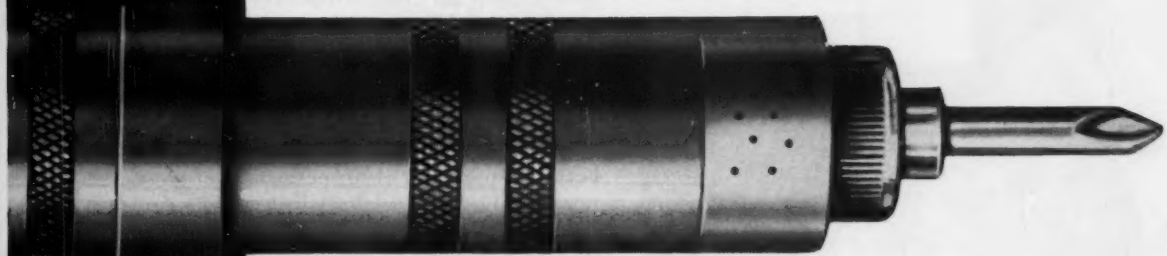
Lucas Machine Division
Cleveland, Ohio
Precision Horizontal Boring, Drilling and Milling Machines

For more information fill in page number on Inquiry Card, on page 231


"Magnamatic"
Shifts to Neutral
at desired torque
reduces work spoilage

"Magnamatic" is the only "One-Shot" type of Controlled-Torque screwdriver-nutrunner that has proven itself in two years of heavy-duty "on the line" service in industry! Typical of hundreds of satisfied users is a large mid-western company, whose 40 "Magnamatic" Screwdrivers-Nutrunners have:

- **Reduced bit breakage to 1/20th**
- **Reduced production delays**
- **Reduced rejects caused by damaged work surfaces**
- **Reduced noise levels from 83 to 68 db.**
- **Minimized screwdriver maintenance**



The instant a "Magnamatic" air-driven screwdriver-nutrunner reaches desired torque its automatic "One-Shot" clutch shifts to neutral. There's no harmful hammering, impacting or ratcheting to run fasteners past proper tightness and to damage surfaces, break bits, burr screw heads, strip threads or shear fasteners. And "Magnamatic" is *Quiet* . . . clutch buzz is eliminated and exhaust noise is muffled by a new principle of baffling. For complete details call your Chicago Pneumatic sales office or mail coupon.
Chicago Pneumatic Tool Company,
8 East 44th Street, New York 17, N. Y.

CAPACITIES:
#4 screws to ⅜" bolts.
Reversible and non-reversible types.

Chicago Pneumatic Tool Company, Dept. M-41
8 East 44th Street, New York 17, N. Y.

☐ Please send me FREE booklet SP-3165 "Magnamatic" Case Histories

☐ Please send me "Magnamatic" Bulletin SP-3126

☐ Have representative call

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Chicago Pneumatic

Pneumatic Tools • Air Compressors • Electric Tools • Diesel Engines
Rock Drills • Hydraulic Tools • Vacuum Pumps • Aviation Accessories

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SOUTH BEND 13" LATHES

Illustrated — 13" x 5' bed Toolroom Lathe, less motor and controls, f.o.b. factory. $2049

for accurate, low-cost machining

South Bend 13" Lathes are popular where there is a variety of precision parts to be machined. Costs drop as their accuracy and efficiency keep production flowing fast even on the "headache" jobs. Operators prefer them for their simplicity and practically effortless handling. Also, set-ups and change-overs are made so quickly and easily that down-time is held to a minimum.

Now is the time to find out how these quality-built lathes can also bring you better machining at lower costs. Let your near-by South Bend distributor show you how they can ease your production, toolroom and maintenance machining problems. Or, mail coupon for literature on the 13" Toolroom and Engine Lathes.

SPECIFICATIONS

Swing—13½" over bed and saddle wings, 8" over saddle cross slide.

Distance Between Centers—28", 40" and 52".

Collet Capacity—1" maximum (collets interchangeable with 10"-1", 14½", 16" and 16-24" South Bend lathes).

Spindle Bore—1⅜".

Spindle Speeds—Six to Sixteen 40 to 940 r.p.m. or 20 to 940 r.p.m. approximately.

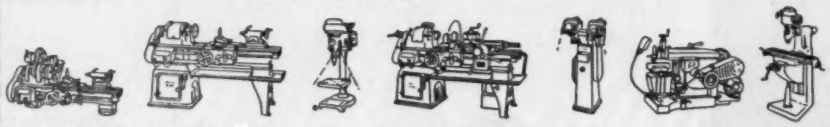
Longitudinal Feeds—48 R.H. or L.H., .0015" to .0841".

Cross-Feeds—48, .0006" to .0315".

Thread Cutting—48 R.H. or L.H. pitches, 4 to 224 per inch.

SOUTH BEND 1906 50th ANNIVERSARY 1956

PLEASE SEND INFORMATION CHECKED:



☐ 9" and 10" BENCH LATHES ☐ 10" to 16-24" FLOOR LATHES ☐ DRILL PRESSES ☐ ½" & 1" Collet TURRET LATHES ☐ TOOL GRINDERS ☐ 7" BENCH SHAPERS ☐ MILLING MACHINES

Name_____ Street_____

City_____ State_____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

For more information fill in page number on Inquiry Card, on page 231

No other automatic on the market provides as high a degree of accuracy for work up to 2" diam. as the Brown & Sharpe No. 4 Automatic Screw Machine! And its advanced design permits top productivity on every job. For example: Super-precise spindle construction allows limits as close as 0.0003" — even at top speeds! Engineered production rates for each job *assure* maximum precision and efficiency under all conditions — hold repetitive production to close tolerances. A large, extra-convenient turret speeds set-ups and adjustments. In addition, electric control allows tools to be "jogged" easily into position; or a complete cycle to be run through by hand. And the No. 4's exclusive spider-wheel stock loader enables even a 100-lb. girl operator to easily engage a 2" bar! The unique capabilities of the No. 4 Automatic are making possible new profits in precision production — even on critical jobs like the one illustrated. It's the most *practical* automatic for all larger precision work. Write for full details. Brown & Sharpe Mfg. Co., Providence 1, R. I.

THE MOST ACCURATE AUTOMATIC for larger work!

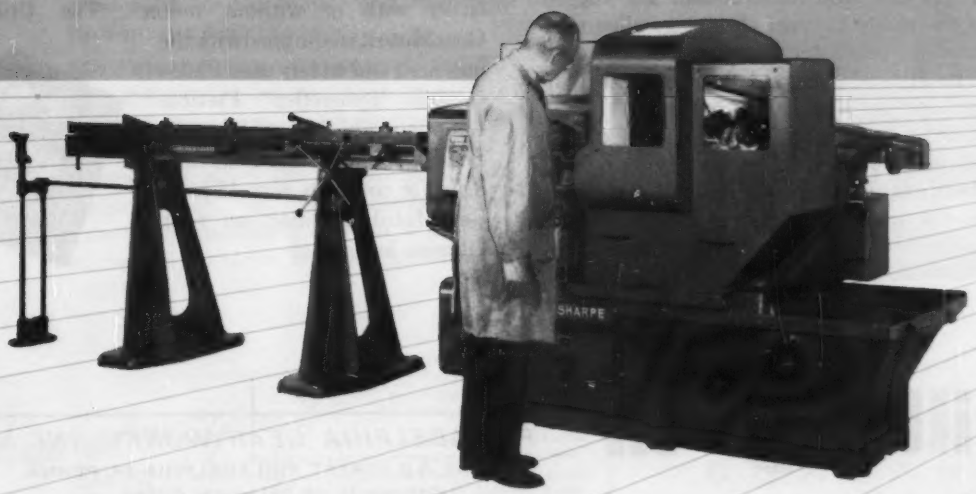
. . . the Brown & Sharpe No. 4 Automatic Screw Machine

MACHINE SPECIFICATIONS

Stock diameter	to 2"
Stock diameter (with outside feed)	to 2⅛"
Speed range	1965 to 17 R.P.M.
2-speed combinations	168
Speed ratios (12)	2.2:1 to 13:1

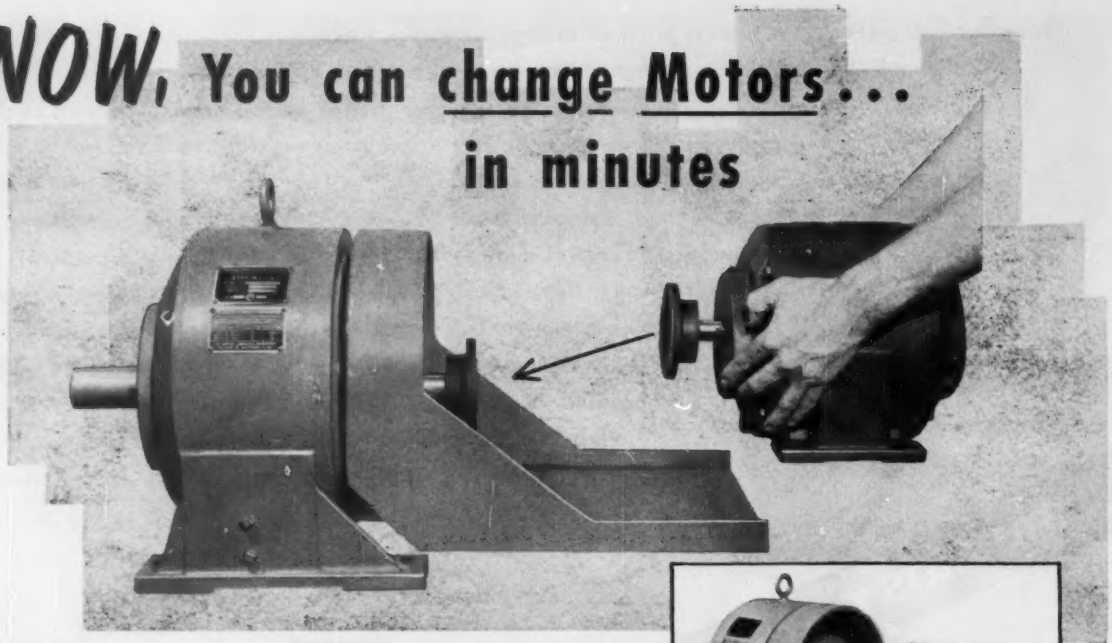
Even this Job is Easy on the No. 4!

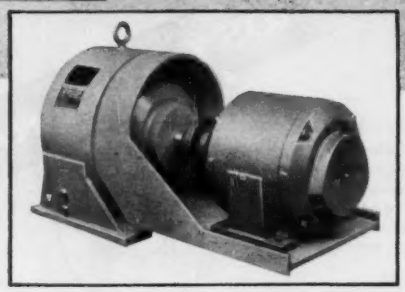
Tolerances:
Bore I.D. 0.0003" to 0.0004"
Concentricity of bore 0.0005"
Large O.D. 0.0005"
(Overall diameter of work approx. 2")



Brown & Sharpe

NOW, You can change Motors... in minutes





with the Phillie Gear utility GEARMOTOR

Motors can be interchanged or replaced in a matter of minutes, merely by unbolting the old motor, separating the coupling halves, and bolting-on the new motor. *No long and costly "down-time".* Replacement of standard foot mounted motors is not limited to the original make of motor.

The Philadelphia Utility GearMotoR is of heavy, non-corrosive cast iron construction. The rugged design of the motor support eliminates alignment and vibration problems between reducer and motor. The Helical gearing is heat-treated alloy steel, precision cut and shaved after heat treatment, in order to eliminate possibility of distortion; Shafting is of the highest quality, and antifriction bearings are used throughout; Lubrication is by the dip and splash method which requires minimum attention and helps to assure quiet operation and long service life. Remember, the Utility GearMotoR, like all other Phillie Gear Speed Reducers, is the result of over 63 years continuous experience.

These units are available with motors up to 60 h.p., in full range of AGMA output speeds—they can be furnished from stock for prompt delivery, either with or without motors. The Utility GearMotoR is equipped with the patented and widely used Philadelphia "Sphereflex" Flexible Coupling, which provides additional versatility of mounting. Send for complete new 48 page GearMotoR Catalog, on your business letterhead.

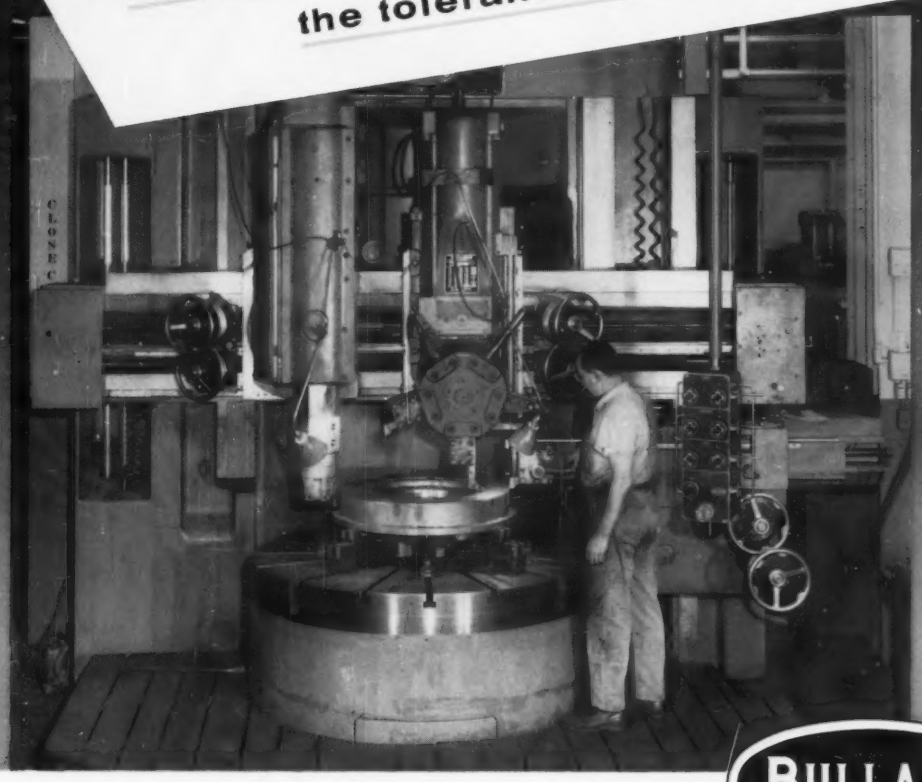
phillie gear®

PHILADELPHIA GEAR WORKS, INC.
ERIE AVE. & G STREET. PHILADELPHIA 34. PENNA.
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID AGITATORS • FLEXIBLE COUPLINGS
Virginia Gear & Machine Corp. • Lynchburg, Va.

For more information fill in page number on Inquiry Card, on page 231

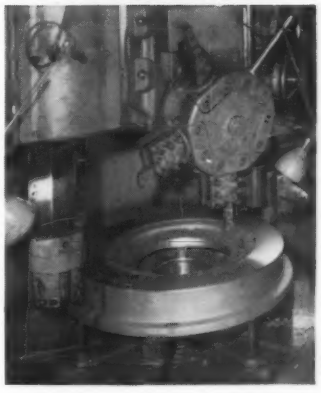
"Few machines would hold the tolerances required"



BULLARD

This statement by Mr. R. P. Feiser, Industrial Engineer of the York Corporation, York, Pa., is one of the reasons for their purchase of a 66″ Cut Master, V.T.L., Model 75 for the machining of a rotor support for their turbomatic compressor.

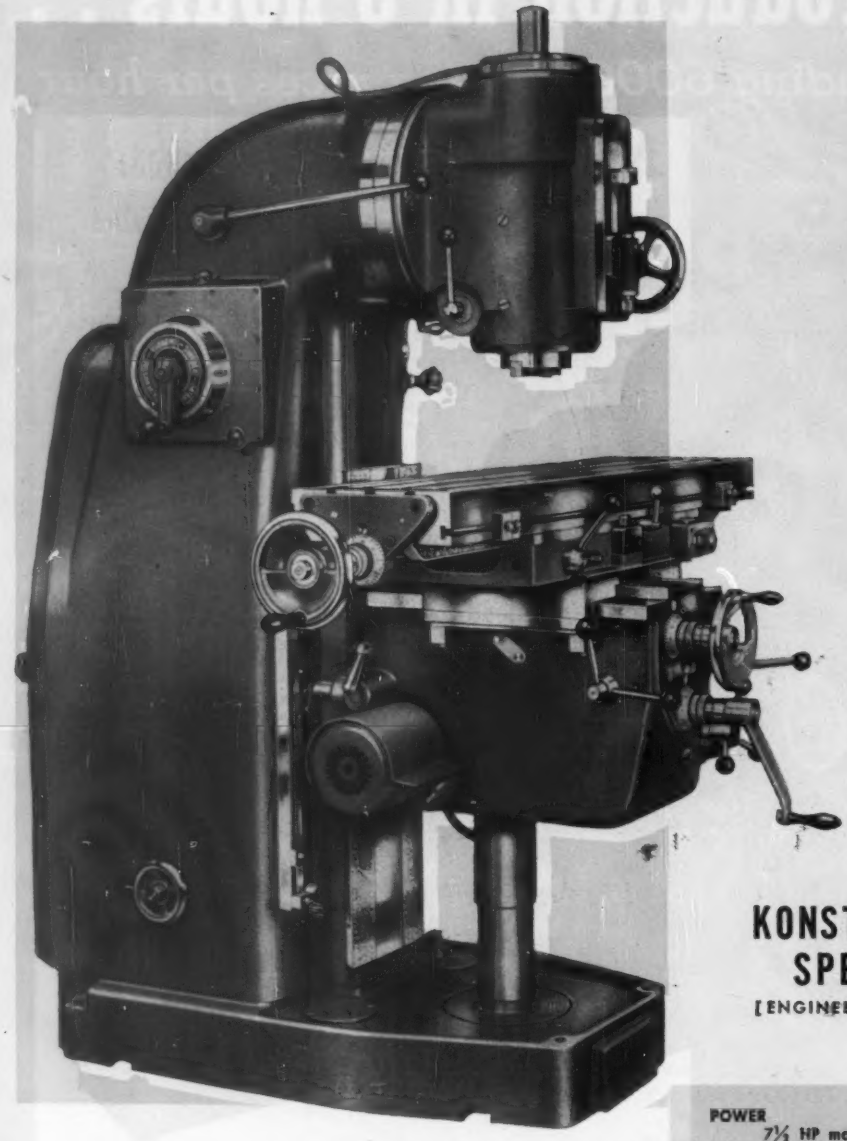
Mr. Feiser further states that "the 66″ Cut Master does this machining at a saving of 40% over any previously used machine. In addition, the pendant control and power swiveling turret head are a great convenience in operation — the result is a low operator fatigue factor. Also, the York Corporation has experienced low maintenance costs on a 60″ Vertical in operation since 1928 and a 36″ Vertical in operation since 1937."



How about You?

Are you employing these same advantages to your machining problems? If not, may we recommend that you get the complete Cut Master V.T.L., Model 75 story by calling your nearest Bullard Sales Office, Distributor or writing for a catalog to

THE
BULLARD
COMPANY
BRIDGEPORT 9, CONN.



KONSTRUERAD FÖR SPECIALISTER

[ENGINEERED FOR SPECIALISTS]

SAJO'S NEW No. 2 VERTICAL MILLER MODEL VF-54

Built to U.S. Standards by Swedish craftsmen, this precision Miller meets exacting requirements at a modest price.

SAJO Model VF-54 is an ALL GEARED Vertical Miller with hand-scraped sliding surfaces, SKF "SP" anti-friction bearings on spindle and gear shafts, hardened chrome nickel gears, ground integral splines on gear shafts, externally adjustable back-lash eliminator for table feed screws, dial-selected feeds and speeds.

POWER

7½ HP motor for spindle (5 HP optional). 1½ HP motor for table feed and 3 direction rapid traverse.

RANGE

16 spindle speeds 59-1500 RPM (31-1200 optional), No. 50NMT spindle, 12 table feeds 1⅛ to 25 inches/min. longitudinal and cross, 1½ to 12½ inches/min. vertical. Power rapid traverse, all directions. Table travel 33½" long., 10" cross, 18" vertical.

CONTROLS

Single adjustable START-STOP-BRAKE lever. Dial selection of speeds and feeds (U.S. inch calibrated) with single lever controls. Magnetic motor starter.

FOR INFORMATION, CATALOGS, AND REFERENCE DATA, WRITE

austin INDUSTRIAL CORPORATION

76-E MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

DEALERS IN PRINCIPAL CITIES • LOOK FOR THE AUSTIN SEAL . . . YOUR FULL GUARANTEE OF SATISFACTION

Here's how you can protect your production equipment from severe metal-cutting coolants

Now . . . a protective coating that will withstand even the stripping action of synthetic coolants. ACTIVATED COPON prevents corrosion damage to expensive machine tools . . . adds years of service life. Just three coats will provide long-lasting protection from constant spillage or complete immersion in coolant mixtures.

COPON coatings offer a ready solution to industry's most persistent corrosion problems. They adhere tenaciously to metal, wood, or concrete surfaces and provide outstanding protection against action of chemical fumes, chemical spillage, salt or fresh water and many other contaminating factors. Each coating is the result of extensive research and careful testing and has been designed to do a specific job.

A complete technical service is provided to assist you in selecting the COPON coating to solve your particular corrosion problem. Write today for details.

COPON is available in a wide variety of colors and may be easily applied by spray, brush, dip or roller coating methods.

Get complete information about COPON. Mail coupon to manufacturer located nearest to your city.

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Please send me information about COPON Coatings for Corrosion Control.

Name_____

Company_____

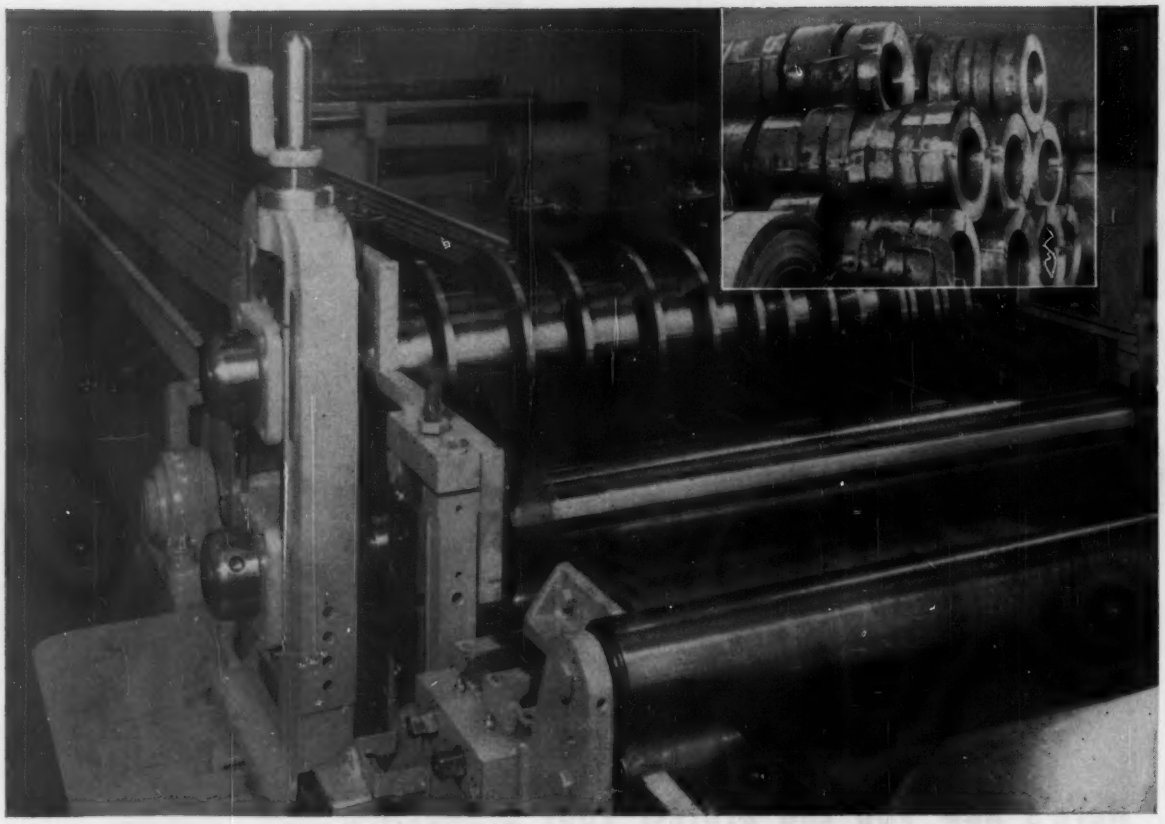
Position_____

Address_____

City_____ State_____

M-7

For more information fill in page number on Inquiry Card, on page 231



...these things and others, too, a Yoder Slitter can do for you...

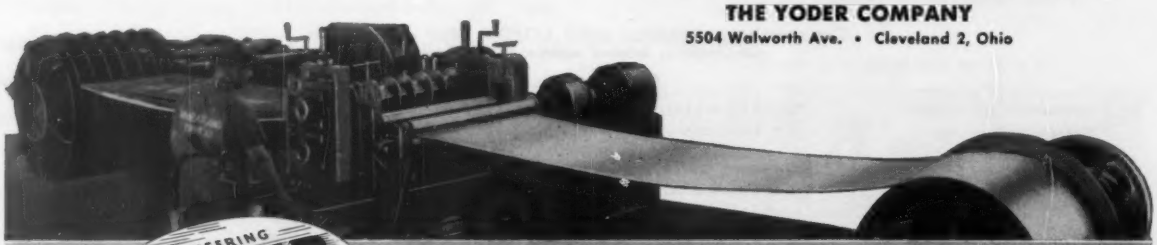
By doing your own slitting, you may easily save $12,000 or more per year in slitting cost alone, on requirements as low as 100 tons per month.

But don't make the mistake of thinking this is the only saving or advantage enjoyed. Many owners realize equally important savings by being able to buy standard width coils competitively, from more numerous sources of supply—wherever they can get the best price and quality. Much quicker deliveries are also obtainable in this way.

Inventory requirements, too, are greatly reduced and production planning simplified because, from a relatively small stock of mill-width coils or sheets, you can meet expected and unexpected needs for slit strands in a few hours.

Send for the Yoder Slitter Book—a comprehensive text on the mechanics and economics of slitters and slitting line operation, with time studies, cost analyses and other valuable data. It's yours for the asking.

THE YODER COMPANY
5504 Walworth Ave. • Cleveland 2, Ohio



ENGINEERING YODER MANUFACTURING

ROTARY SLITTING LINES
COLD ROLL FORMING MACHINES
ELECTRIC-WELD PIPE AND TUBE MILLS

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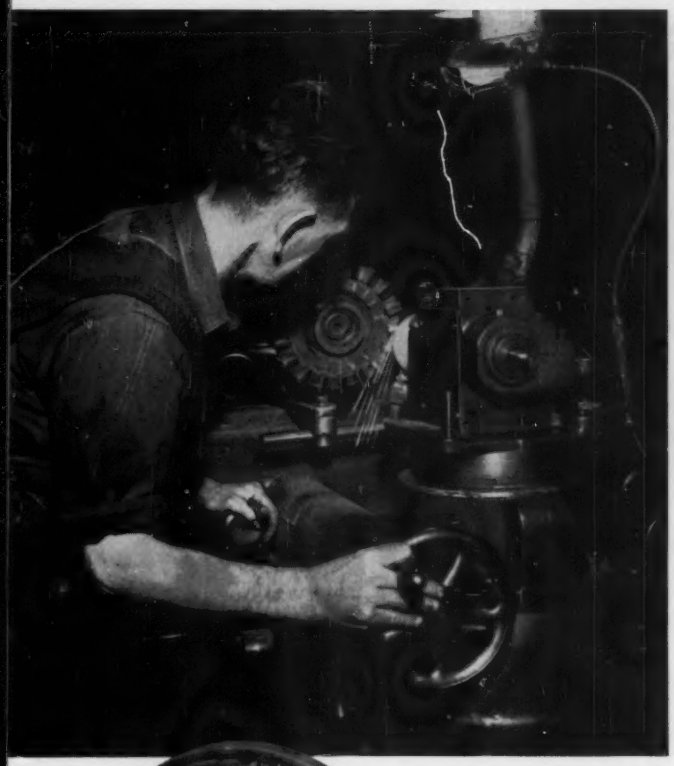
Why Sterling adds a sixth element to your grinding wheel formula

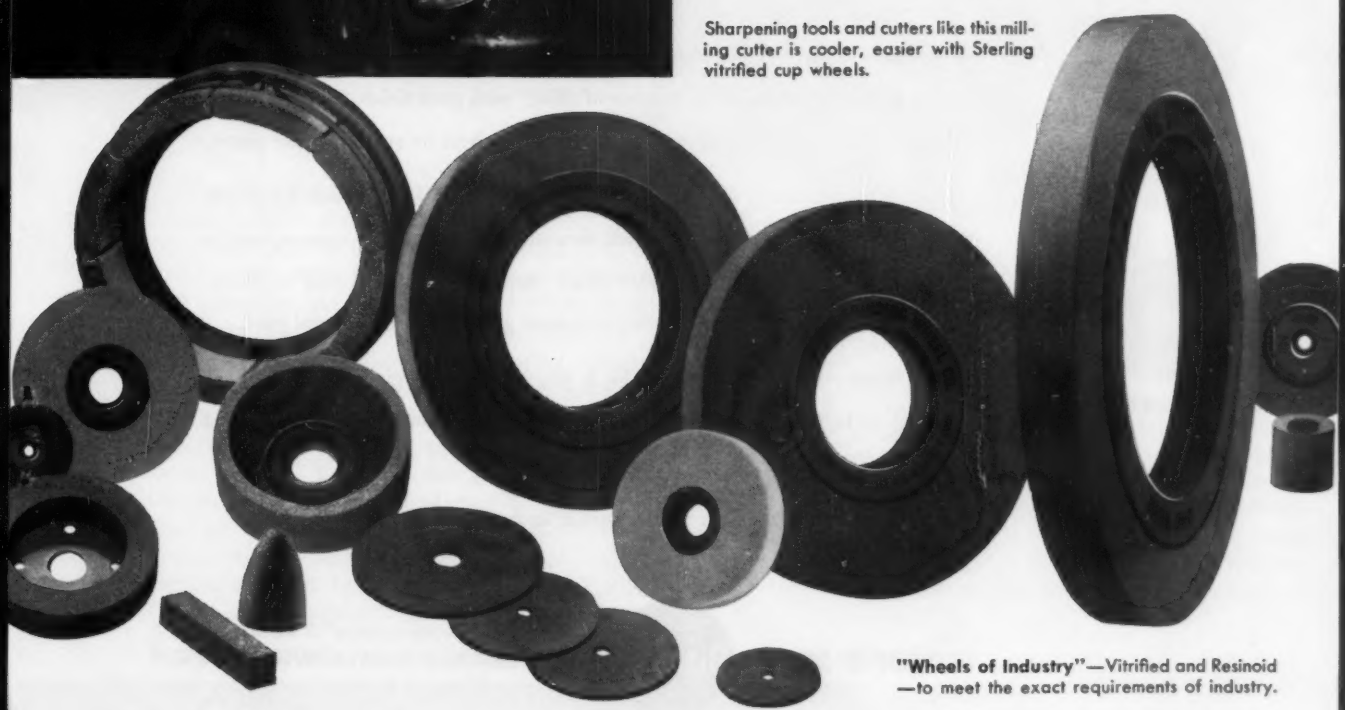


YOUR GRINDING WHEEL'S performance is determined by the five elements that make up its specification: abrasive grain, size, grade, structure, and bond. But in determining the precise formulation of these five elements, Sterling always considers a *sixth* element.

The sixth element is the *human* element: the operator himself, his work habits, personal preferences, and all the other little things that make your job unique. Considering the vital sixth element may mean the difference between success and failure on any grinding operation.

Sterling grinding wheels—formulated with the sixth element in mind—can cut your grinding costs, reduce grinding time, and get maximum production from your machines. That's why it's sound practice to call in a Sterling Abrasive Engineer, or your nearest Sterling Distributor, for a complete study of your grinding operation. Do it soon.

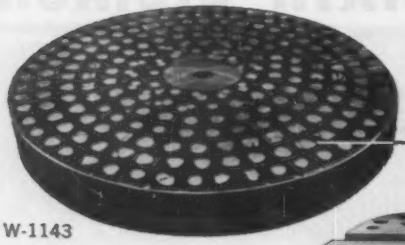
Sharpening tools and cutters like this milling cutter is cooler, easier with Sterling vitrified cup wheels.



"Wheels of Industry"—Vitrified and Resinoid —to meet the exact requirements of industry.

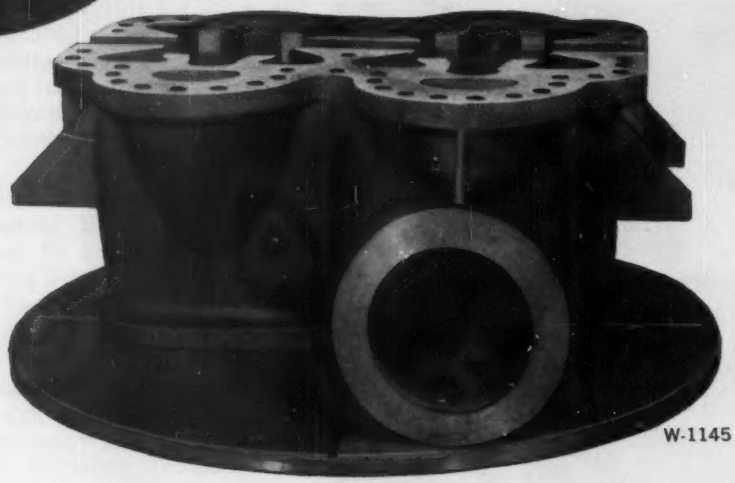
STERLING GRINDING WHEELS

STERLING GRINDING WHEEL COMPANY, TIFFIN, OHIO—SUBSIDIARY OF ABRASIVE AND METAL PRODUCTS COMPANY



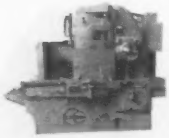
W-1143

tiny or **tremendous...**

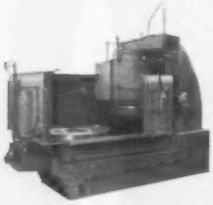


W-1145

For best results... ***PUT IT ON A BLANCHARD!***



Blanchard No. 18



Blanchard No. 42-84

There's a Blanchard for every surface grinding job, in a broad range of sizes. For example, the Blanchard No. 18 grinds non-magnetic transistor elements (upper left) .006" thick, to a tolerance of .0005" with good finish. This job, which involved .006" to .008" stock removal per side, was held on special fixture plates.

At the other end of the scale, a huge Blanchard No. 42-84 Grinder grinds a turbine housing (upper right) which measures 83" across the corners, and is 28" high. This housing, ground after rough machining, required .020" stock removal. Both this piece and its mating part were ground to a steam-tight joint.

Whatever *you're* grinding—be it tiny watch parts, giant steel plates, or anything in between—there's a Blanchard designed to do the job speedily and accurately.

Ask for details on the 15 standard Blanchard models.

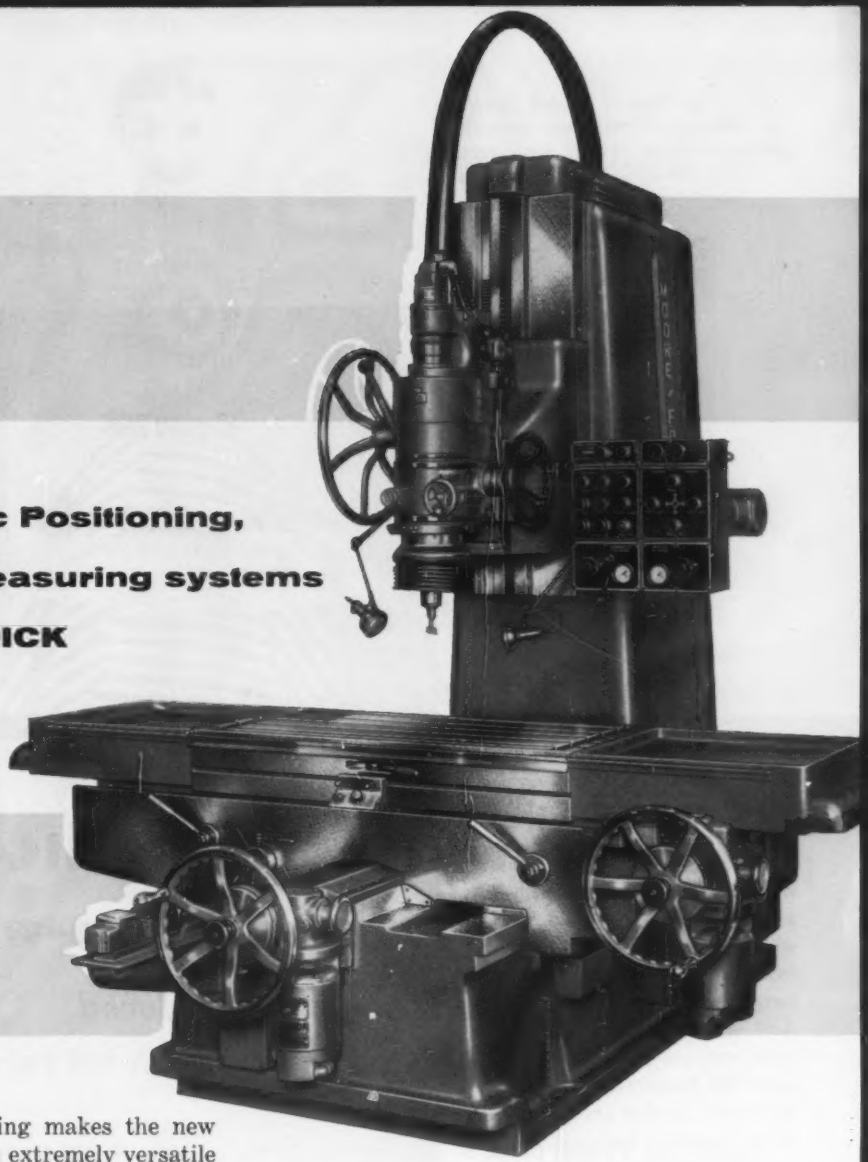
PUT IT ON THE BLANCHARD

Send for free copies of "Work done on the Blanchard", fourth edition, and "The Art of Blanchard Surface Grinding".

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

For more information fill in page number on Inquiry Card, on page 231

NOW...Automatic Positioning, choice of two measuring systems on MOORE-FOSDICK Jig Grinder!



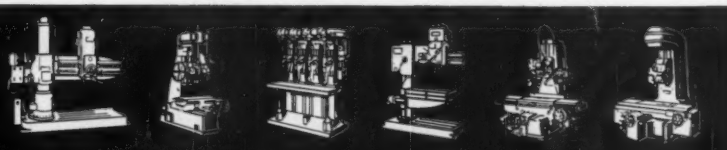
Exclusive automatic positioning makes the new Moore-Fosdick Jig Grinder an extremely versatile machine! Besides large work capacity (22" x 44" or 18" x 36" x 27" height) you get increased speed and precision. At the touch of a button, table and saddle position automatically to ± .0001"!

A choice of two precision measuring systems is available. With the new and exclusive Direct Dimension Measuring, dimensions from blueprint are simply set on direct-reading drum dials. The other system, Rod and Bar Measuring, employs measuring rods, micrometers, and for high production work, duplicating bars. Either measuring system may be installed with or without automatic positioning, but both systems cannot be installed on the same machine.

On the Moore-Fosdick Jig Grinder you can grind conical holes with taper in either direction, as well as cylindrical holes. An angular and indexing device built into the main spindle, and the recently developed slot grinding attachment, give quick, accurate grinding of any contour — *regular or irregular*. Write for price and delivery information.

Other outstanding features include: infinite range of grinding speeds—12,000 to 60,000 rpm, contour and chop grinding, spindle-housing heat control.

NEED JIG GRINDING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!



Fosmatic Radial Drills | Jig Borers | Sensitive and Upright Drills | Sensitive Radial Drills | Jig Grinders | Automatic Positioning Jig Borers

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

FOSDICK

Maytag switches to STANICOOL HD *Soluble Oil... makes two-way saving*

1 *Cost of soluble oil reduced*

2 *Soluble oil consumption cut two-thirds*

A 300 ton Verson press at the Maytag plant, Newton, Iowa, is used for piercing holes in the inner tubs of Maytag's fine automatic washers. Material used is 18 gauge enameling iron. Holes are pierced in six automatic cycles. A total of 936—$\frac{3}{16}$ inch holes and 6—$1\frac{9}{32}$ inch holes are incised in each tub.

A check of manufacturing costs on the tubs disclosed that the cost of soluble oil per unit produced was too high. Standard Oil lubrication specialist J. I. Nelson, working with plant management, suggested a switch to STANICOOL HD Soluble Oil. The switch was made and Maytag received the first part of its two-way saving: the cost of soluble oil per gallon was reduced. Then it was found that the same high quality product could be turned out, without loss of tool life, while spraying only every third tub. Formerly *each* tub was sprayed with soluble oil before punching. With STANICOOL HD, Soluble Oil consumption was reduced two-thirds. And thus, Maytag received part two of its two-way saving.

Perhaps STANICOOL HD Soluble Oil can help you make similar savings. Find out more about this quality soluble oil. Call your nearby Standard Oil office. There is one near you in any of the Midwest or Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

...PRODUCTION MACHINE TOOL CO., CINCINNATI 23, OHIO

Maytag, leader in cutting laundry time for modern homemakers, knows how to cut manufacturing costs, uses STANICOOL HD.

Dwight Norton (right), a Maytag plant foreman, inspects automatic washer inner tub with Jesse I. Nelson, Standard Oil lubrication specialist. Jesse Nelson is well qualified to provide lubrication technical service. He has a B. S. degree in engineering from the University of Iowa and has completed the Standard Oil Sales Engineering School. Jesse has been helping customers with lubrication problems for more than three years. Customers find his experience and training pay off *for them*.

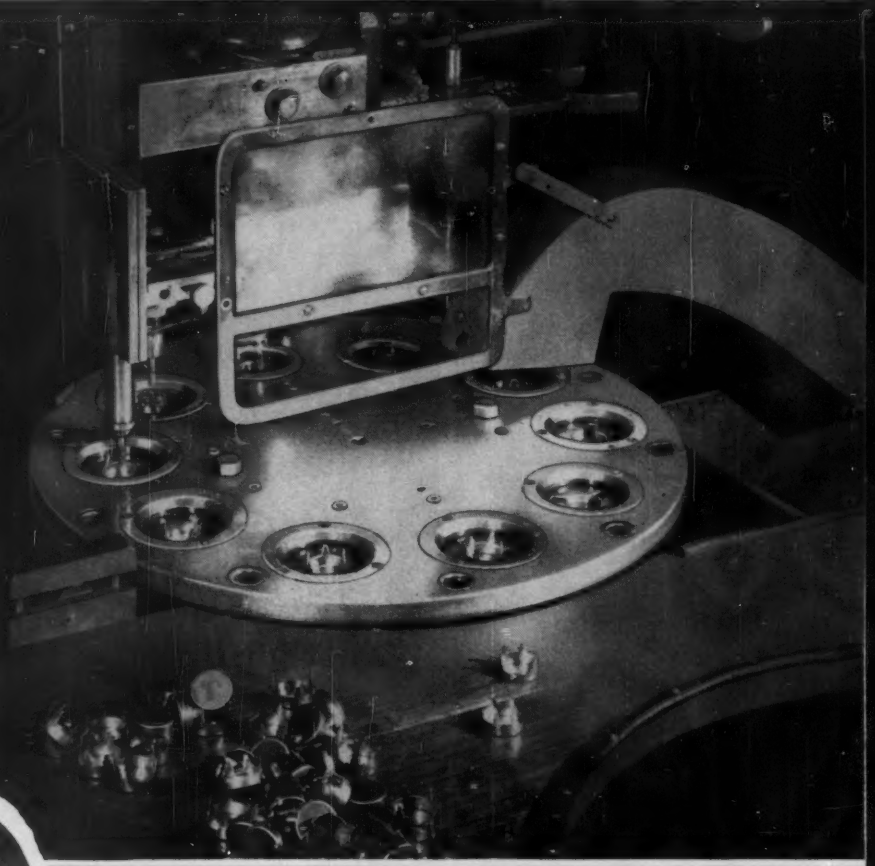
Quick facts about STANICOOL HD Soluble Oil

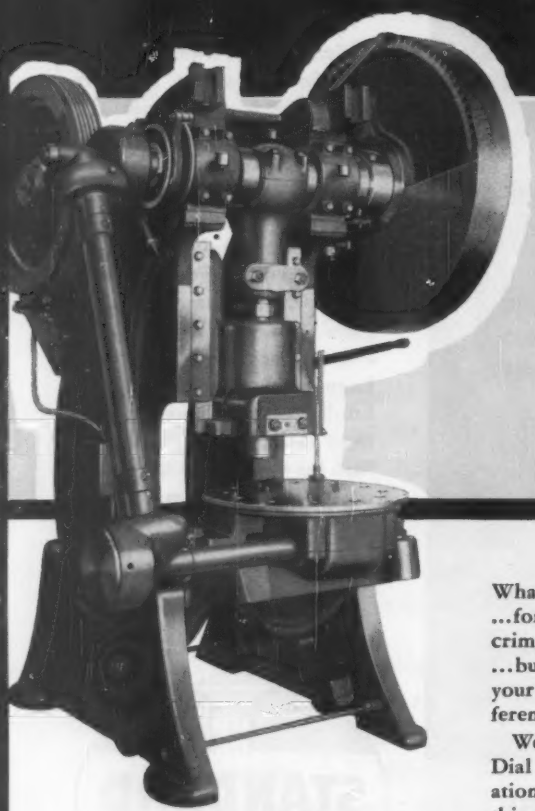
- Emulsifies readily with all waters.
- Forms stable, uniform emulsion.
- Does not turn rancid.
- Non-injurious to men, machines and work.
- Economical. Meets work requirements with relatively low emulsion concentrations.
- Prevents rusting of work and machines.
- Gives better tool life.
- Doesn't form gum on machines.

STANDARD

STANDARD OIL COMPANY
(Indiana)

MODERN FEDERAL DIAL FEEDS have what it takes!





No. 7 Dial Feed
Capacity, 80 tons

VERSATILITY plus AUTOMATION

What's the job? Drawing... staking ...forming... piercing... stamping... crimping... punching... broaching ...burring... assembling? Maybe in your plant it's all of them, or a different, unique operation.

We'll lay two-to-one that Federal Dial Feeds are just what your operation needs. For the possibilities of this press with special jigging are practically unlimited. Add automatic feed and ejection and you have the answer to many cost problems.

Modernize now with Federals and eliminate the need for expensive, specialized equipment. Rugged, precision-built Federals embody the finest materials and workmanship. Available in sizes from 6 to 80 tons. *Write for new Dial Feed Catalog.*

THE FEDERAL PRESS COMPANY
601 Division Street, Elkhart, Indiana

FEDERAL DIAL FEED PRESSES

31 Years' Experience in Dial Feed Engineering and Construction

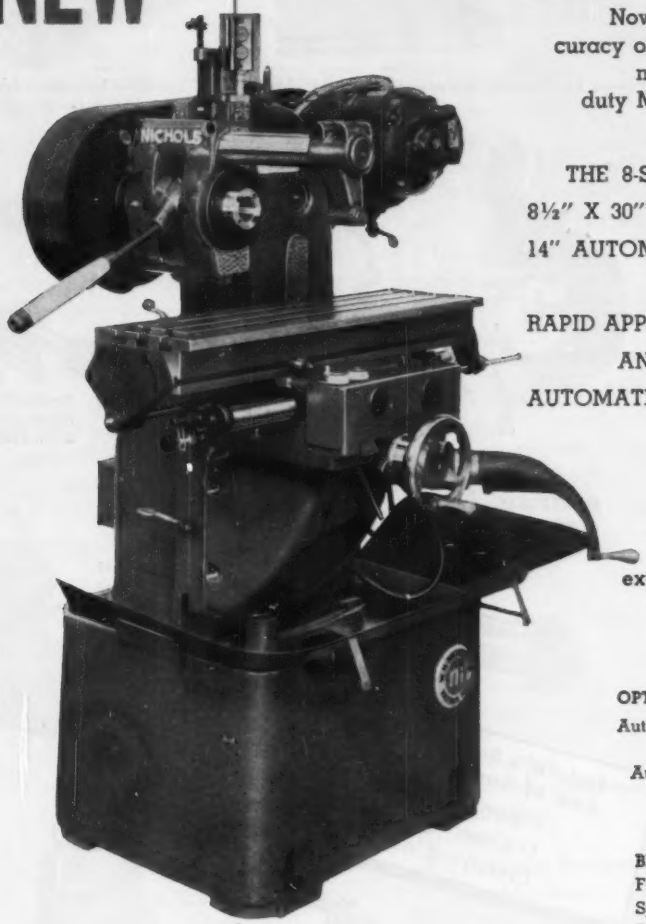
"Anything almost right is wrong"

W. H. NICHOLS
1873 1951

NEW NICHOLS

Semi-Automatic Miller

Now Nichols matches the unequalled accuracy of its famous hand-miller in the new semi-automatic heavy duty Miller #8-SA.



THE 8-SA MILLER BY NICHOLS PROVIDES
8½" X 30" TABLE WITH 3 T-SLOTS
14" AUTOMATIC PNEUMATIC LONGITUDINAL TABLE FEED WITH
RAPID APPROACH, SLOW CUTTING FEED, AND RAPID RETURN . . .
AUTOMATIC TABLE WAY LUBRICATION.

The Nichols 8-SA is a production miller with vertical and transverse table screw feed featuring a **heavier knee** and **extra wide saddle** for greater bearing surface . . . air equipment **inside** the saddle saves space.

OPTIONAL:

Automatic Pneumatic Down Feed To Spindle Head
Automatic Pneumatic Transverse Table Feed
Automatic Milling Cycle through synchronization of any two pneumatic feeds.

BRIEF SPECIFICATIONS: • Table 8½" x 30"
Feed 0-60" min. • Rapid traverse 300" min.
Spindle speeds available up to 5000 rpm.
Range: Longitudinal table feed 14"
Transverse table travel 6"
Vertical travel of knee 11"
Rise and fall of spindle head 4½"

Write for catalog on the Nichols way to increase production and lower costs. Reservation may be made for sound, color film, "The Miller That Uses Its Head".

W. H. NICHOLS COMPANY
WALTHAM 54, MASS.

National Distributors
NICHOLS-MORRIS CORPORATION • 76-E Mamaroneck Ave., White Plains, N.Y.

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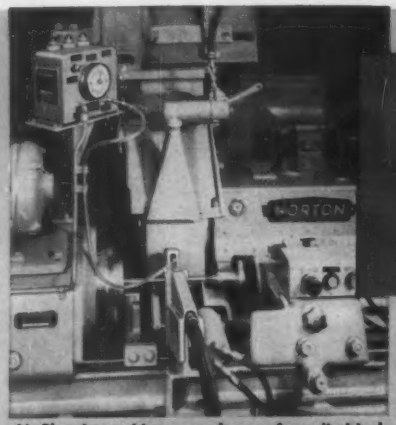
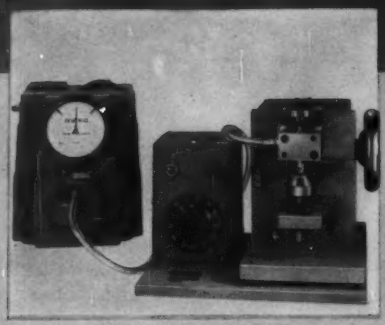
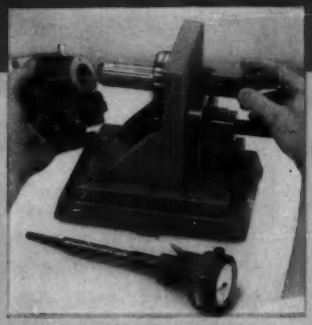
How would you



Air-Electric machine control gage for cylindrical grinder.

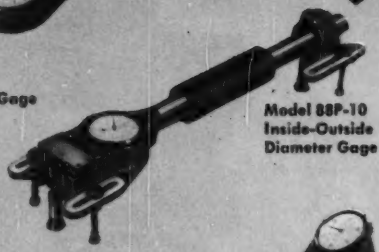

Gage for checking gyroscope rotor end play.

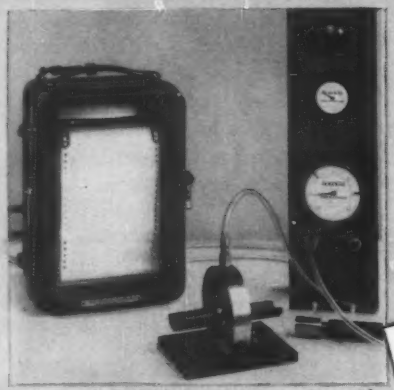

Series 205 Hole Location Gage checks holes in workpiece for parallelism.

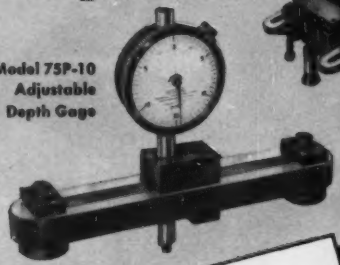
Gage for checking taper on piston skirts.

Model 1000P-61 Adjustable Snap Gage

Series 1250 Hole Gage


Model 88P-10 Inside-Outside Diameter Gage

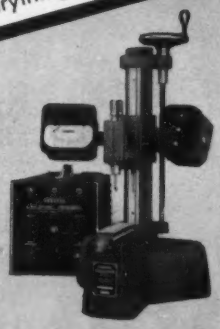

Recording individual measurements taken with an air-ring.


Model 75P-10 Adjustable Depth Gage

Series 45 Thread Pitch Diameter Gage

Federal's Solution to the Cost of Gaging:
Impartial Gage Selection
Engineering Follow-Through
Everything in Gages

No. 247 radial play gage for ball bearings.


Model 130 Electronic Comparator

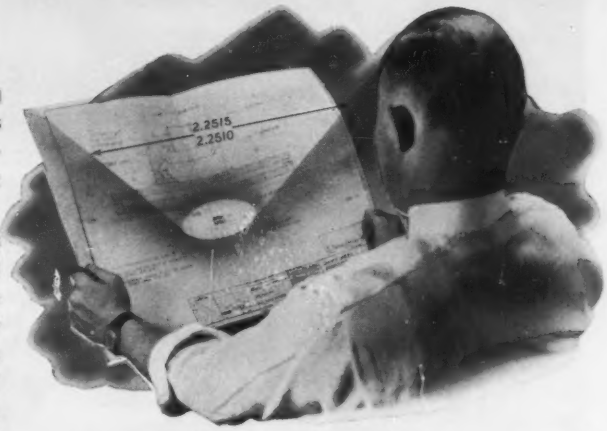
Model 136 Horizontal Master Comparator

GAGE THIS DIMENSION 10 times or 10,000 times?

It is claimed that 75% of all metalworking production is made up of small lots of 25 workpieces or less. This emphasizes that in most cases it is important to carefully select gages at the lowest cost commensurate with necessary accuracy.

Federal makes a complete line of all types of gages employing practically every system of visual gaging. Listed in our catalog and readily available from stock are countless Dial Indicator Gages ideally suited for everyday inspection of small runs. When a higher degree of accuracy, foolproof operation, and faster gaging are required, the purchase of a Federal Dimensionair Air Gage may pay big dividends. And where large production warrants the investment, we design and build automatic gages for high speed sorting and machine control.

When a manufacturer makes only certain types of gages, he naturally recommends these for all applications. For instance, a manufacturer who specializes only in Dial Indicating Gages obviously cannot meet every modern gaging requirement. Neither can an Air Gage manufacturer honestly recommend his type of gage for every measuring job. Those who buy the wrong gage can't be blamed if they don't know the facts.



Before you decide what gages you need, bring your problems to Federal. Our engineers, without bias, will suggest the *best* solution . . . and may save you considerable money. Write or call us today.

FEDERAL PRODUCTS CORPORATION
6119 Eddy Street • Providence 1, R. I.

Air-Electric Gages

Air Gages
a full line of accessories

Automation Gages
Employing all gaging systems

Grinding Gages
Continuous

Dial Indicator Gages
Catalog and Special Types
Thousands of Designs

Dial Indicators
The only complete line
Regular type — hundreds of Variations
Super-sensitive
Perpendicular indicators
Test indicators
Lifetime
Dial Indicator Test Sets
Wetproof Indicators
Long range indicators

Electric-Dial Indicator Gages

Electronic Gages

Micrometers
Indicating

Master Setting Disc & Rings

Multiple Dimension Gages

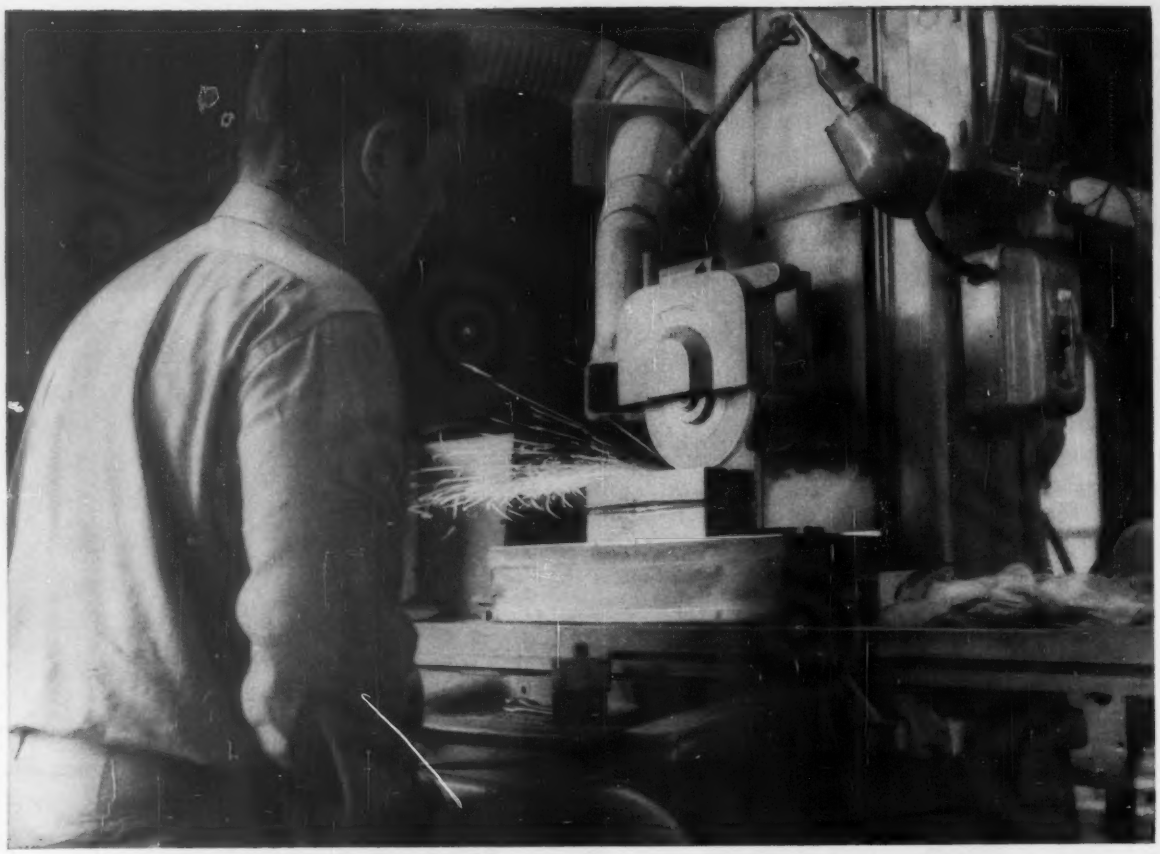
In-process Gages

Thousands of special designs for thousands of special needs

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging



"5 years ago Cities Service solved all our lubrication problems and we've never had another!"

A report from Banner Spring & 4 Slide Co., Van Dyke, Michigan

These Were The Problems 5 Years Ago: Banner Spring & 4 Slide Company, maker of small parts for the automobile, electrical and refrigeration industries, was having trouble. Ways, bearings, and drive shafts on 4 Slide machines were getting insufficient film strength from lubricants and constantly burning out. Likewise, compressors were also running hot, and there was complete puzzlement over what type of lubricant to use for Banner's high-speed sewing machines.

Banner decided to call in a Cities Service Lubrication Engineer. A thorough survey followed, with the man from Cities Service carefully examining each machine and its particular operating conditions.

This completed, he made his recommendations – Trojan H-2 Multi Purpose Grease for the 4 Slide machines, Pacemaker No. 1 Oil for the compressors, and Pacemaker 00 Oil for the high-speed sewing machines.

Banner followed these recommendations to the letter. Result: Not one lubrication problem in the past five years – despite the fact that machinery runs 24 hours a day!

If you're faced with a lubrication problem – or if you're just not sure if your present lubricant is best for the job – talk with the man from Cities Service. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

SOME BANNER PRODUCTS: The firm makes all kinds of round wire forms, wire springs, metal clips and flat springs. Use for such products ranges from auto fender support rods to "burlap listings"—the wire frames sewn into burlap which back up automobile upholstery.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Diesel Fuel Injector Parts Get Precision Flatness, Finish and Parallelity on Lapmasters®

. . . here's why and how

"John Crane" Lapmasters are taking over the highly critical and essential job of making diesel fuel injectors absolutely leak-proof—and doing it at a considerable reduction in cost over previous methods.

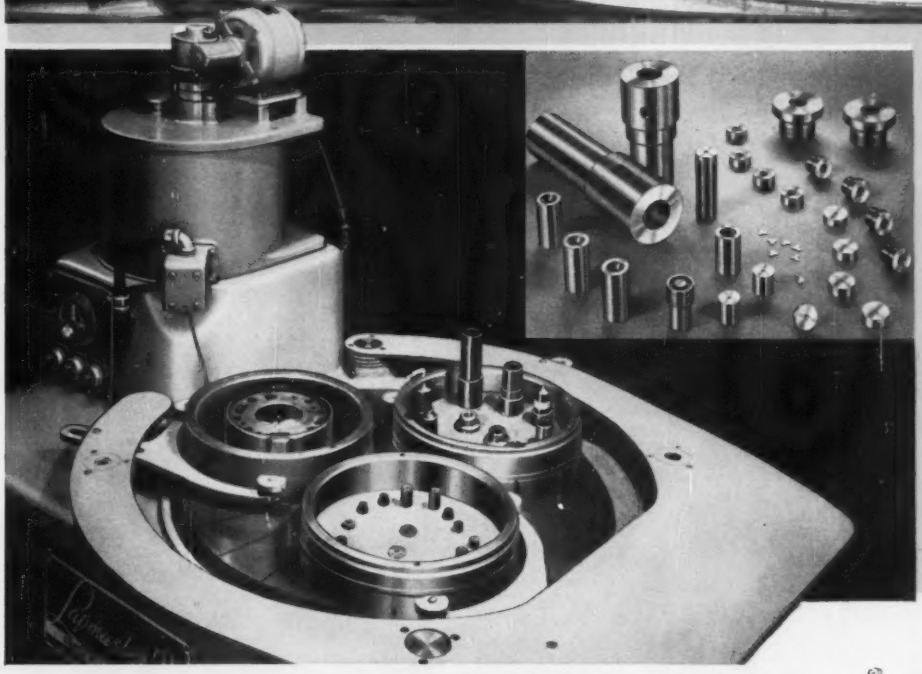
Both engine shops and injector manufacturers have found the Lapmaster a highly successful machine tool for obtaining the required flatness and finish on the mating surfaces of valve nozzle bodies, holders and spacers . . . have found they can run any combination of parts best suited to their production requirements . . . have reduced inspection and rework to the vanishing point.

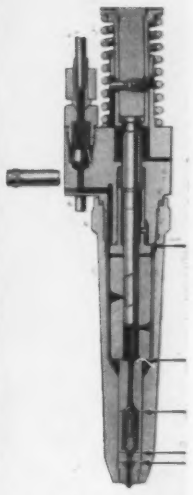
Lapmasters consistently produce flatness to less than one light band (11.6 millionth of an inch) surface finishes of 2 to 3 RMS on practically every kind of material including all ferrous metals, magnesium, aluminum, brass, carbon, ceramics and plastics.

There is a correct size Lapmaster for your requirement. Investigate the possibilities of this modern machine for your work.

FREE DATA

Send for these three booklets which describe in detail how to produce and measure precision flatness and finish.

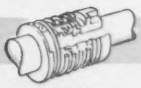




ARROWS SHOW MATING SURFACES LAPPED

John Crane

MECHANICAL PACKINGS



SHAFT SEALS

TEFLON PRODUCTS

LAPPING MACHINES

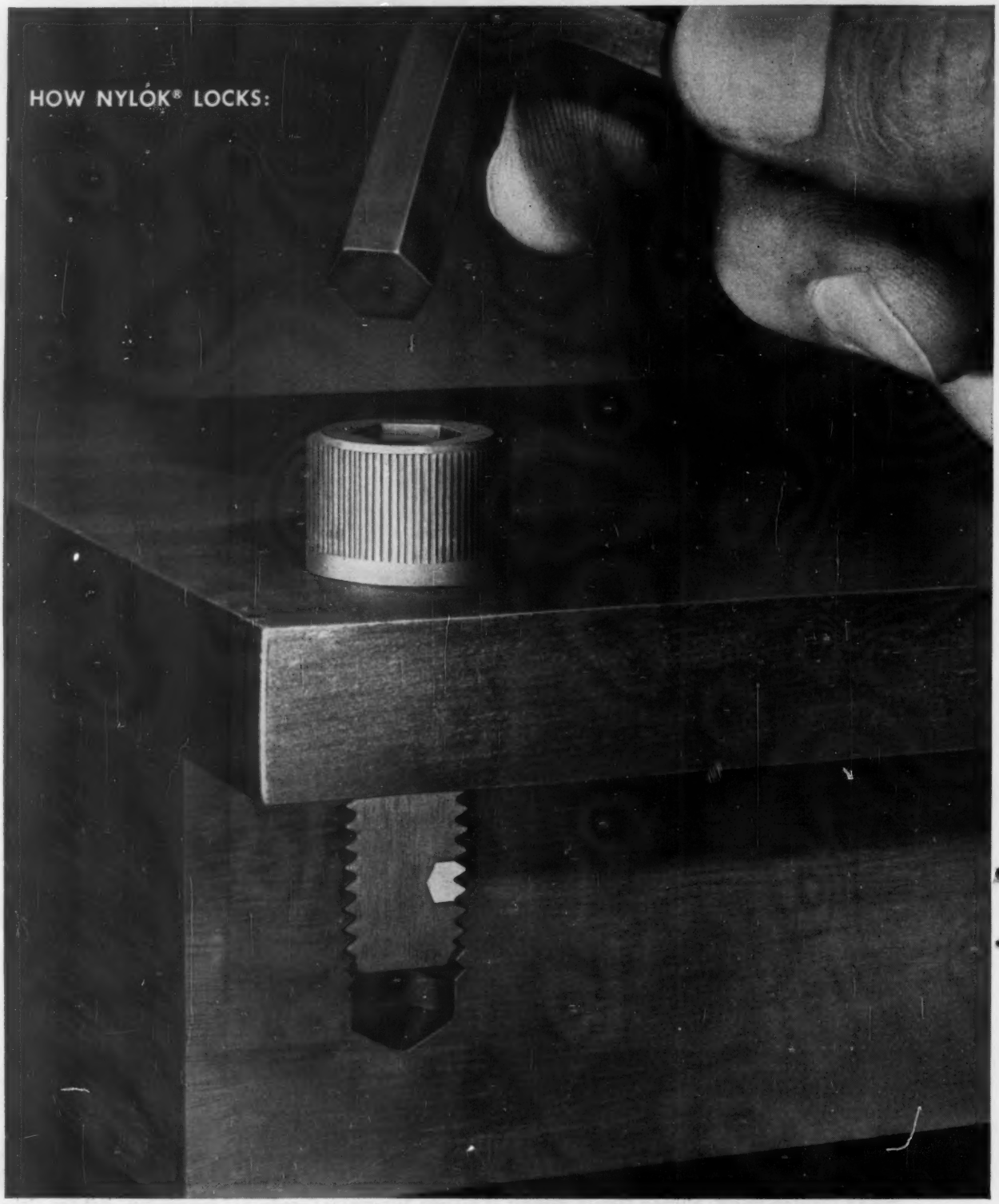
THREAD COMPOUNDS

CRANE PACKING COMPANY

6433 Oakton Street, Morton Grove, Illinois (Chicago Suburb) *In Canada: 617 Parkdale Ave., Hamilton, Ontario*

For more information fill in page number on Inquiry Card, on page 231

NEW—self-locking UNBRAKO

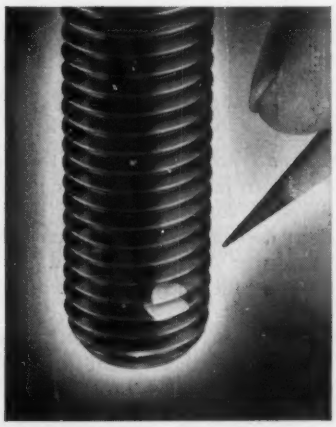


LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together and locks the screw securely.

socket head cap screws

Self-locking UNBRAKO socket head cap screw.

BEFORE ASSEMBLY. The nylon pellet projects slightly. When assembled, threads will be impressed into it.



AFTER REMOVAL. "Plastic memory" of pellet has expanded impressed threads to greater diameter than screw threads. Screw can be used repeatedly. In use, "memory" keeps threads tightly locked.

They won't work loose. And they simplify design and save production time.

UNBRAKO socket head cap screws are now available embodying the Nylok* self-locking principle. Nylok provides the first truly practical solution to the problem of making cap screws self-locking.

An UNBRAKO cap screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not work loose.

You save production time when you make products with self-locking UNBRAKOs. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. And in many cases you will save weight and mass by using shorter screws in tapped holes instead of drilling through and using nuts and lockwashers.

Self-locking UNBRAKOs are reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, when screws are properly seated, the locking pellet also functions as a liquid seal.

A complete line of self-locking UNBRAKO socket screw products, in a wide range of standard sizes, materials and finishes, is available through your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

**T.M. Reg. U.S. Pat. Off., The Nylok Corporation*

UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

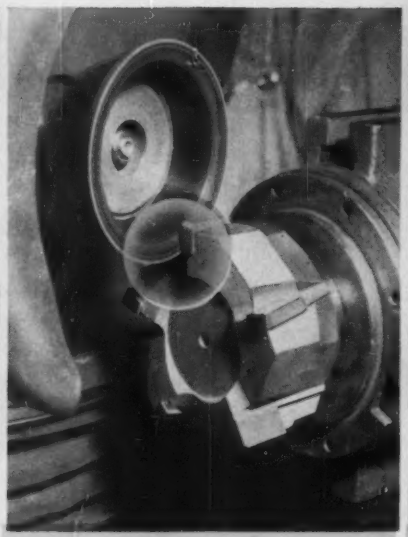
SPS

JENKINTOWN PENNSYLVANIA

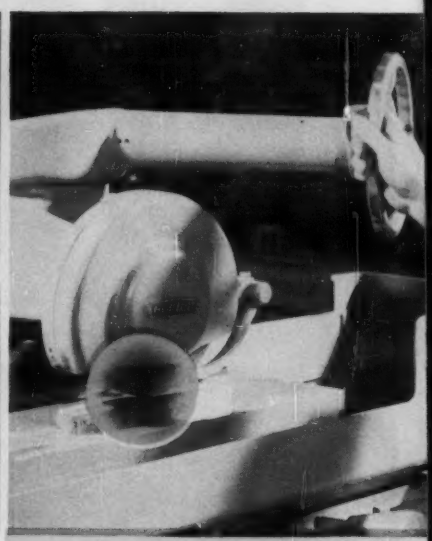
For more information fill in page number on Inquiry Card, on page 231

Add the "Touch of Gold" to

Tool Sharpening



Carbide Grinding



Surface Grinding

. . . with precision processed,

Norton makes wheels for every grinding job in your tool room — and precision-processes them on the most advanced equipment and with the most experienced "know-how" in the field. The result is precise wheel duplication, longer wheel life, and the same money-saving "Touch of Gold" performance every time you re-order.

Top performers from the 100% line of Norton wheels for tool room grinding include:

G Bond Wheels. Made with the most efficient vitrified bond ever produced for precision and semi-precision grinding. For sharpening and for surface, cylindrical and internal grinding on all steels, use G Bond wheels in the exclusive 32 ALUNDUM* abrasive, 38 ALUNDUM abrasive or 19 ALUNDUM abrasive.

Diamond Wheels by Norton are the recognized "Crown Jewels" for carbide grinding — backed by long leadership in diamond wheel development and manufacture. Made in the regular B resinoid bond for wet grinding and the B6 resinoid bond for dry grinding.

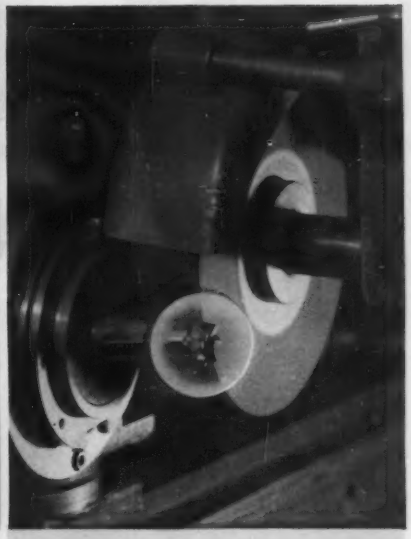
K Bond Wheels in CRYSTOLON* abrasive are an excellent investment for carbide grinding. The vitrified K Bond, in half-grade hardness increments, enables you to "pin-point" specifications.

Cut-Off Wheels made in abrasive-and-bond combinations for all tool room applications, wet or dry, on every type of machine.

every tool room grinding job

Cylindrical Grinding

Internal Grinding



Cutting-Off

precision duplicated Norton wheels

Remember: Norton makes tool room grinding machines as well as wheels . . . knows how to build wheels to machine requirements . . . and offers you the longest experience in both grinding machines and grinding wheels to help you produce more at lower cost. See your Norton Distributor for aid in wheel selection and a copy of the new revised handbook on tool room grinding. Or write to the nearest District Office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

NORTON
ABRASIVES

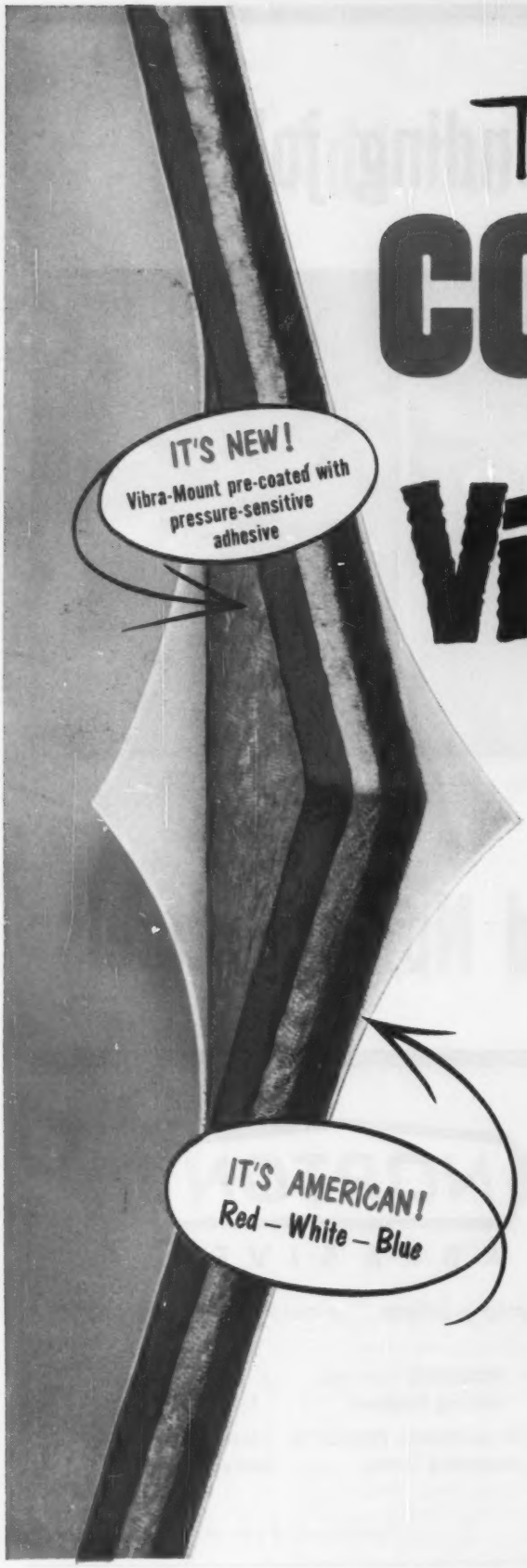
Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

W-1731



This FELT can CONTROL that Vibration!

When machinery has the shakes, put it on Vibra-Mount* Felt. This resilient cushion greatly reduces the amount of vibration transmitted to the floor, as much as 85%. People are happier, buildings safer. Vibra-Mount Felt is long lived because it takes compression with a minimum of set. In almost every case lag bolts are unnecessary, so machines can be rearranged with a minimum of difficulty. Write for FREE booklet, "How to Reduce Vibration." For technical information, ask for Data Sheet No. 10.

*T. M. Reg.

American Felt Company

TRADE MARK ®

GENERAL OFFICES: 68 GLENVILLE ROAD, GLENVILLE, CONN.
SALES OFFICES: New York, Boston, Chicago, Detroit, Cleveland, Rochester, Philadelphia, St. Louis, Atlanta, Greenville, S. C., Dallas, San Francisco, Los Angeles, San Diego, Portland, Seattle, Montreal.—PLANTS: Glenville, Conn.; Franklin, Mass.; Newburgh, N. Y.; Detroit, Mich.; Westerly, R. I. —ENGINEERING AND RESEARCH LABORATORIES: Glenville, Conn.

SIP

Guaranteed Accuracy

More and more manufacturers apply SIP *Guaranteed* Accuracy to define, establish and maintain high precision in production and measurement to improve quality-of-output and economy-of-operation.

NORTHERN ORDNANCE INCORPORATED

TEMCO AIRCRAFT CORPORATION

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SIP HYDROPTIC 8-P Jig Borer in operation at Hartford Special Machinery Co.

AMERICAN SIP CORPORATION

HIGH PRECISION MACHINE TOOLS & MEASURING EQUIPMENT

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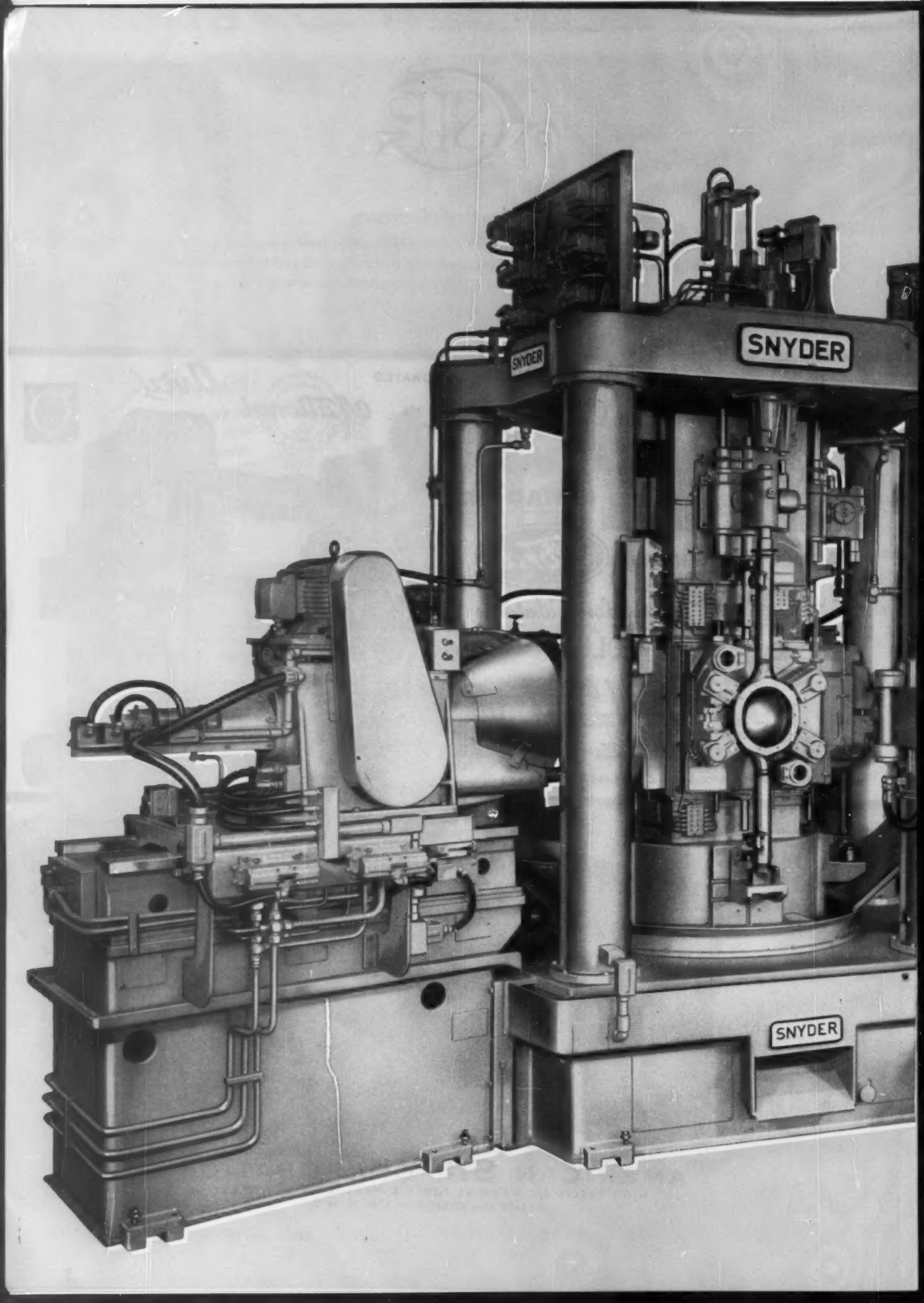

SNYDER
SNYDER
SNYDER

SNYDER VERTICAL TRUNNION MACHINE

for processing rear axle housing assembly; rough and finish faces banjo face, combination drills and reams ten holes in banjo face and chamfers both sides of holes. Production: 105 pieces an hour at 100% efficiency.

SNYDER

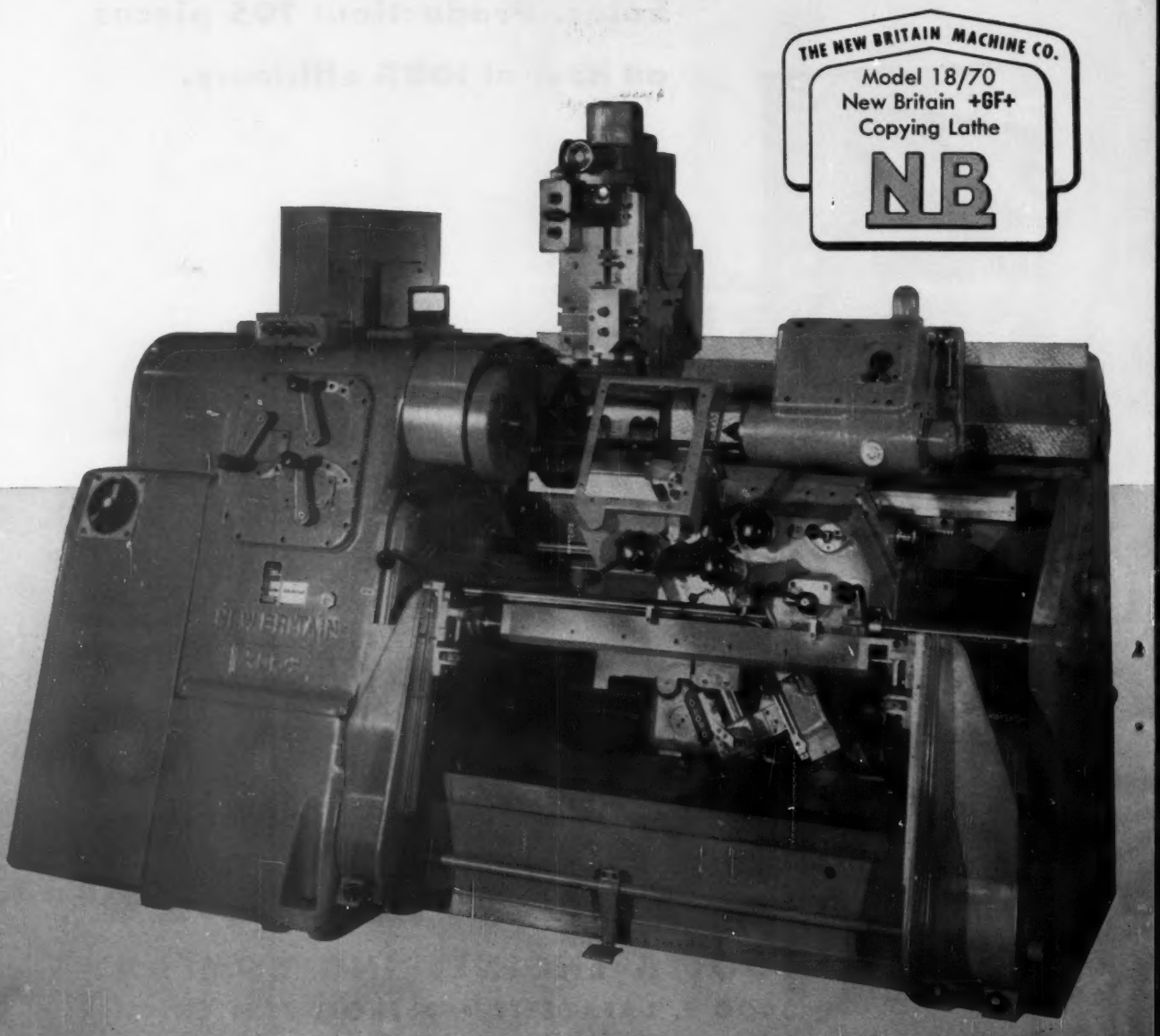
TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

31 Years of Special Machine Tools with Automation

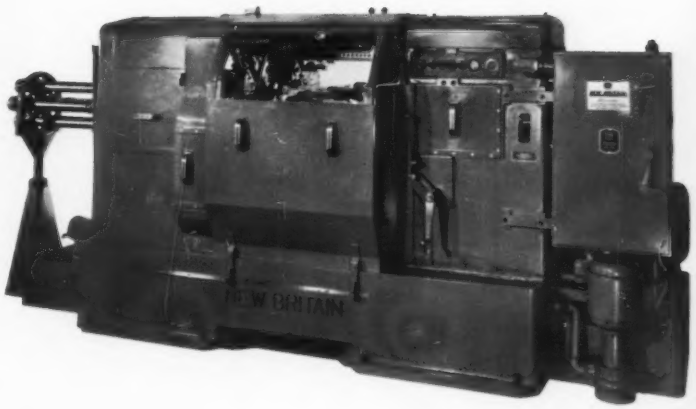
investigate a brand new approach to turning

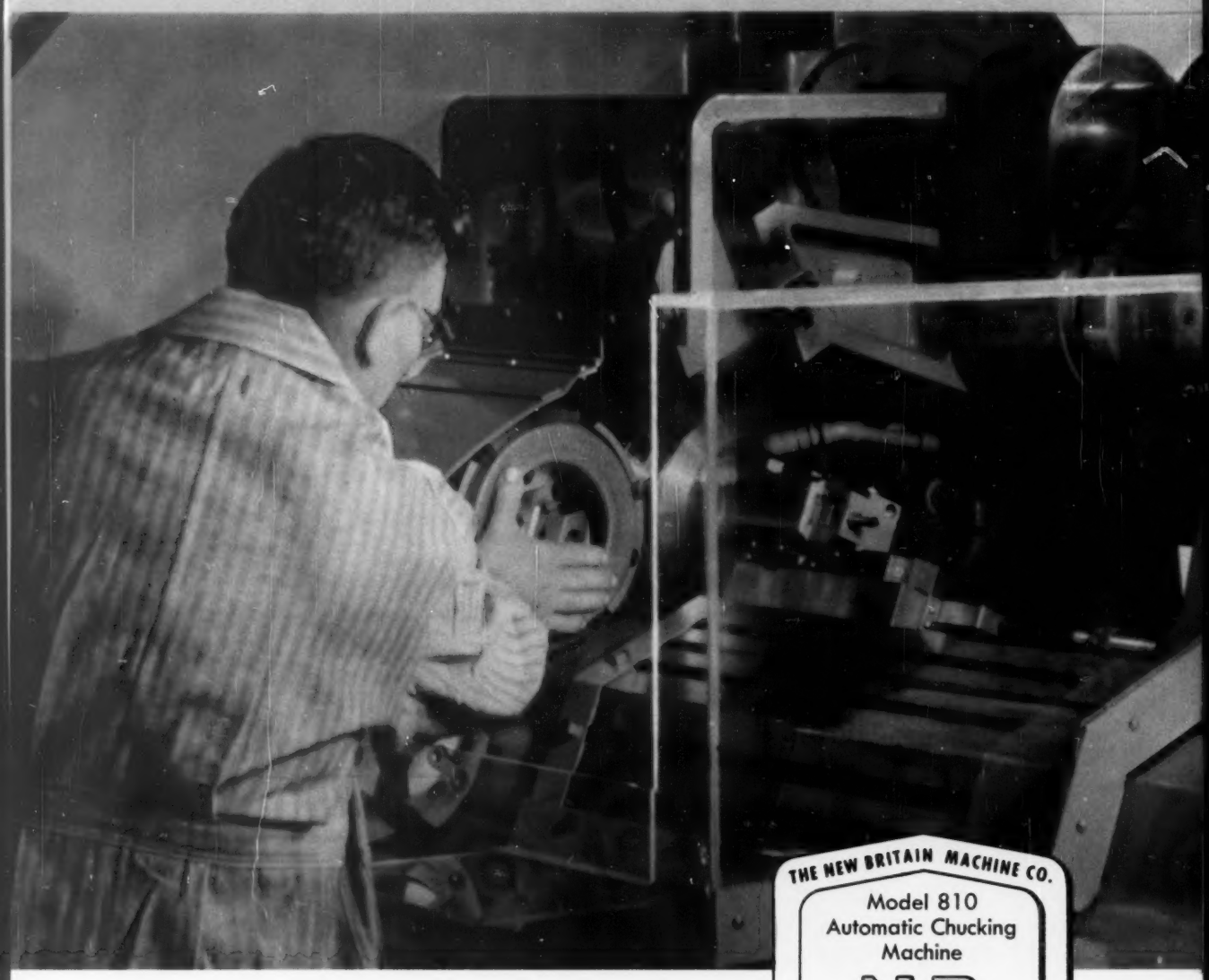
On this New Britain +GF+ Copying Lathe, you can make an accurate first piece from a blueprint—then *copy* it accurately a million times if your requirements call for it. New Britain can supply automatic loading too, if it makes sense on your work. Let us give you the complete story of this new contour approach to turning in a color motion picture demonstration in your office. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



8 tons of metalworking efficiency

If you are interested in absolute minimum cost per piece on either long or short runs, investigate the Model 601 New Britain bar machine. Massive enough and powerful enough to handle your new high-speed cutting requirements. Super-high spindle speeds, maximum versatility, optional universal tool slide cam which eliminates cam change time. With the Model 601 on your floor you have "the shortest distance" between bar stock and finished piece. Write for Bulletin 6H.



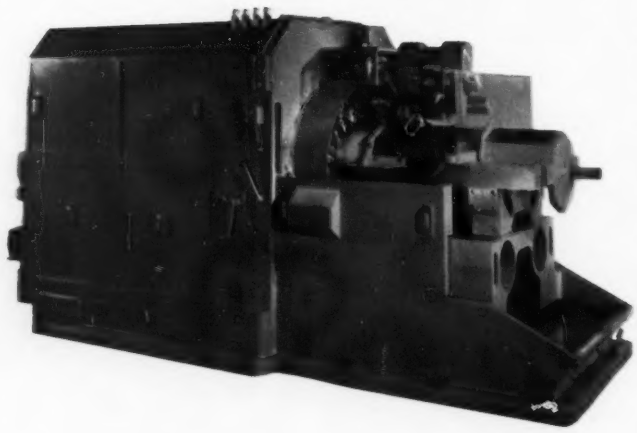


new New Britain chuckers handle bigger work pieces

If you know chucking machines you know the world-wide reputation of New Britains for accessibility, versatility, quick setup and sustained high production of precision parts.

Now new New Britain models enable you to apply this high productivity to pieces with chucking diameters up to ten inches on eight-spindle machines, twelve inches on six-spindle production and fifteen inches on four-spindle work.

Check this practical approach to more profitable production with your New Britain representative, or write for Bulletin 3R. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

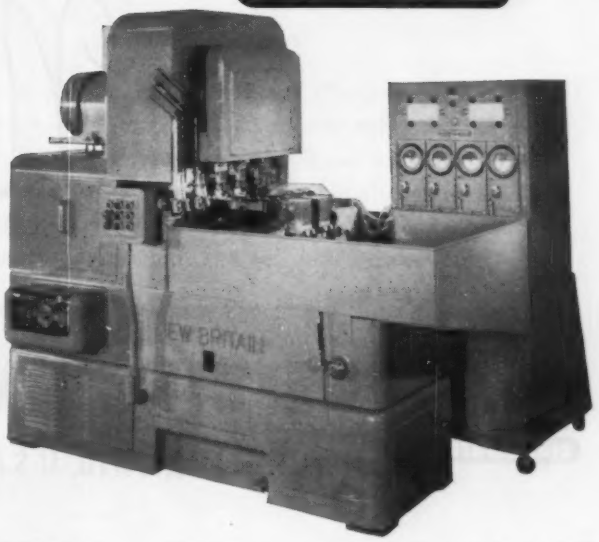


here's fully automatic precision turning and boring

This Model 37 New Britain is a down-to-earth money-making application of automated machining—made practical by automatic loading, *plus* high-spindle speeds, *plus* multiple-spindle production, *plus* automatic gauging, *plus* automatic close adjustment of each tool.

These modern machines, with or without automatic controls, will enable you to make simple work of tough jobs involving such operations as step turning, step boring, boring and facing, turning and facing, grooving, recessing, chamfering or generating contours.

Available in a complete line of horizontal, vertical and double-end models.



New

New Cincinnati Rigid Shapers

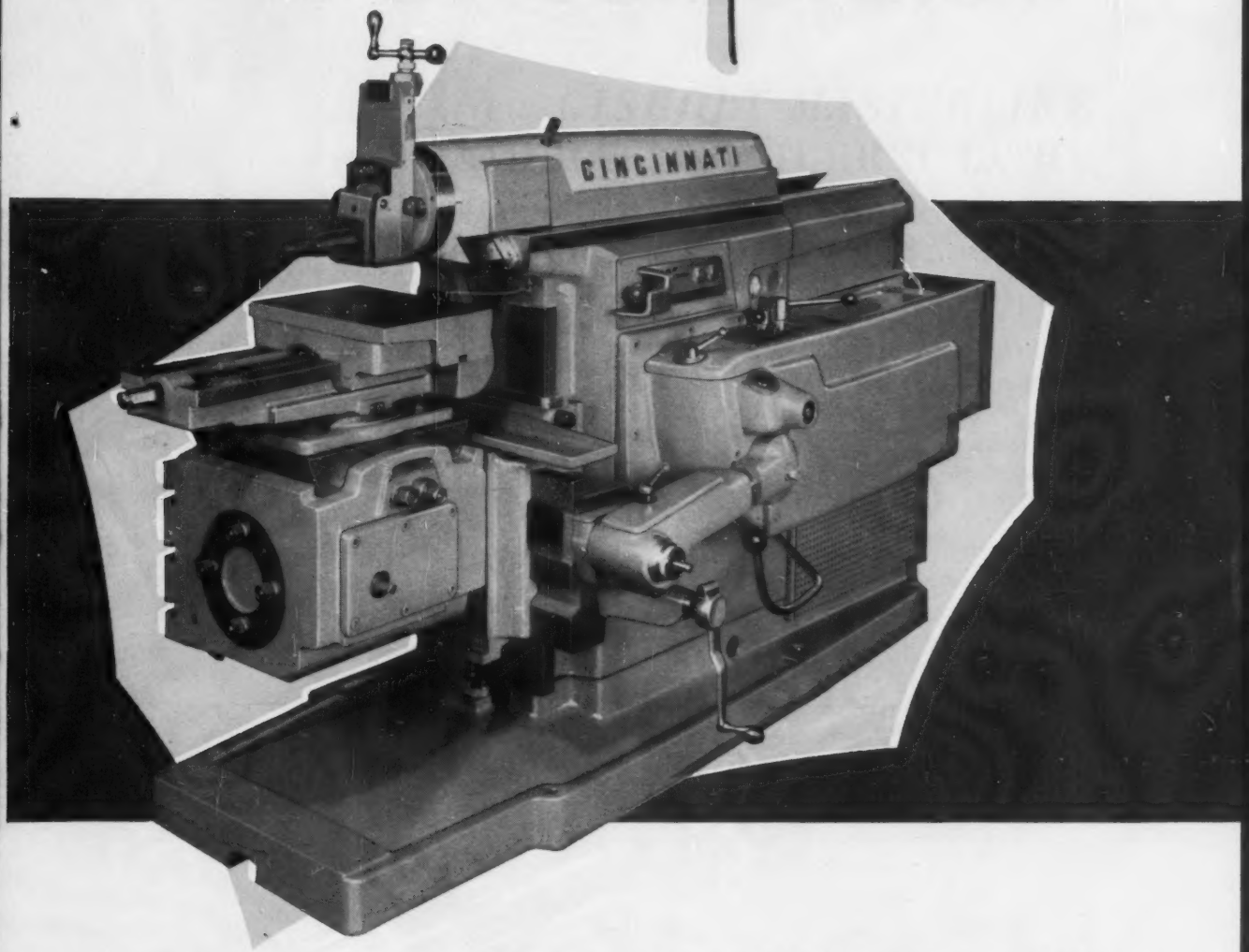
New Look

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A.

SHAPERS • SHEARS • BRAKES

Accuracy...



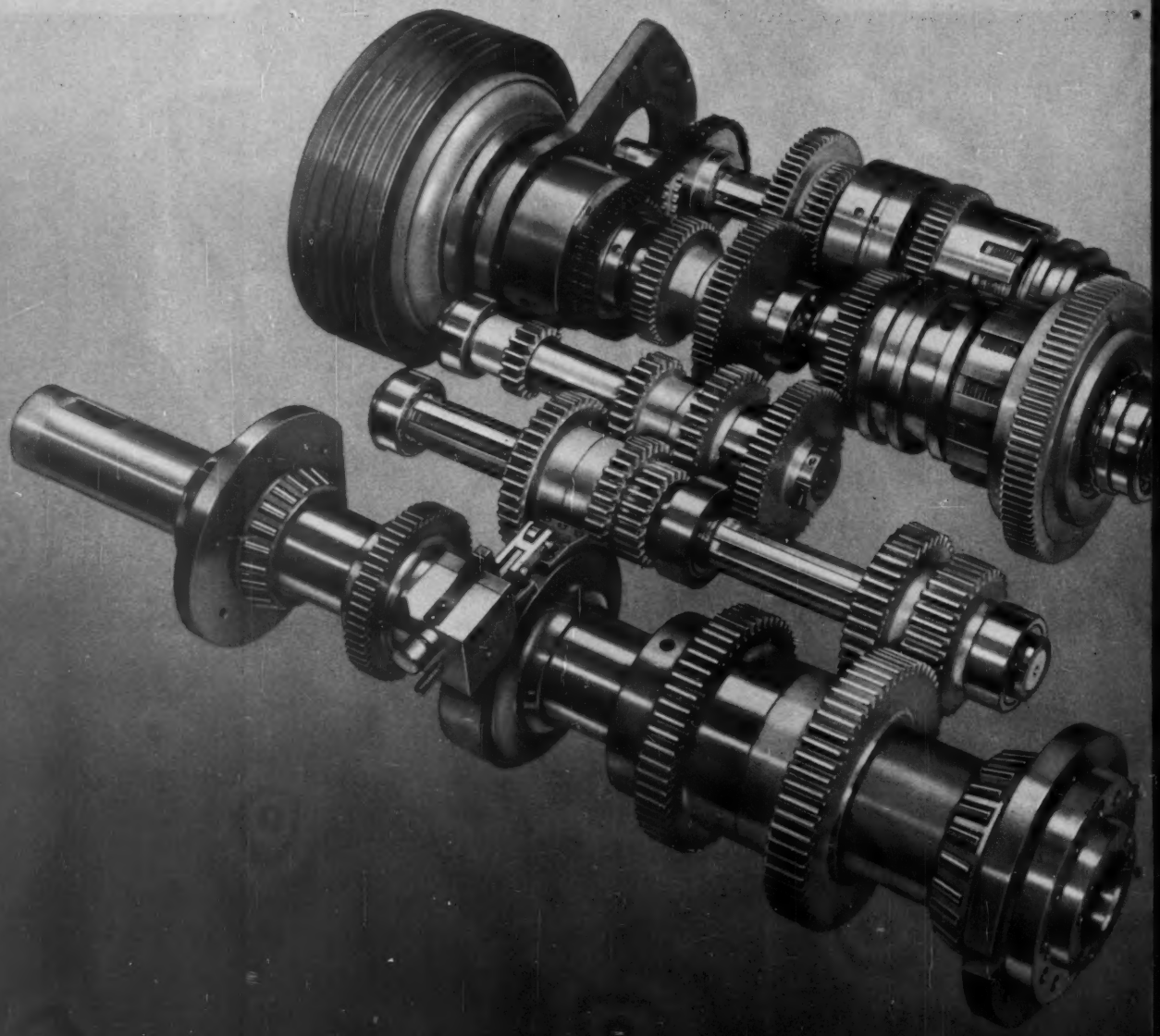
Very rigid and powerful—the New Cincinnati Rigid Shapers give a new accuracy—on heavy cuts and light cuts. They have the most rigid column and ram in shaper history. The Electro-magnetic clutch and brake and 50 PSI positive lubrication are exclusive features that give continued, efficient and accurate performance.

Write for bulletin on these new Cincinnati Rigid Shapers.

For more information fill in page number on Inquiry Card, on page 231

The **power reserve** *and* **range of speeds**

YOU'LL NEED FOR THE



TOOLS OF TOMORROW

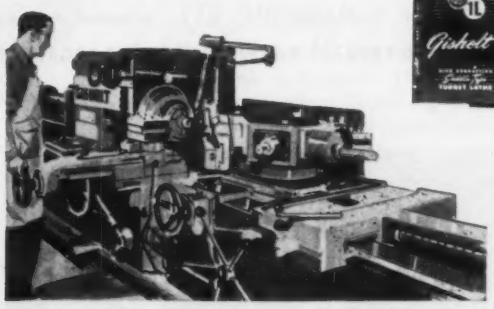
New GISHOLT MASTERLINE SADDLE TYPE TURRET LATHE

WANT MAXIMUM OUTPUT AND ACCURACY from today's carbide tools—with an ample reserve of power and speeds to meet tomorrow's tooling requirements?

That's what you'll get—*now*—from this powerful, rugged Gisholt MASTERLINE Saddle Type Turret Lathe. Prime example of this machine's advanced features is the rugged Headstock Gear Train, shown at the left. Here, you can get 24 different forward speeds—all from a *single*-speed motor. This means you get *full* power *all* the time—a critically important feature for those heavy cuts at punishing feeds.

But that's not all. To give you maximum performance from this powerful gear train, Gisholt designers have backed it with faster speed changes through the Hydraulic Speed Selector (effortless speed shifts without waiting or computing); a hydraulically operated Hi-Lo speed change in a 6:1 ratio (without stopping the spindle or shifting gears); and a new Self-Adjusting Electric Clutch and Brake (smooth, fast starting and stopping, plus more accurate inching of the spindle).

Ask your Gisholt Representative to give you the complete facts. Why not call him today?



ASK FOR complete set of Gisholt MASTERLINE Saddle Type Turret Lathe Bulletins.

GISHOLT MACHINE COMPANY

MASTERLINE GISHOLT SINCE 1887

Madison 10, Wisconsin, U.S.A.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

how's this for

BUILT-IN "AUTOMATION"? ..

(6 broaching operations performed on one machine!)

With all the talk that's going the rounds about automation, you might want to take a look at the multiple broaching operations being performed on this 9mm. automatic revolver barrel — in the plant of one of the country's most prominent makers of high-grade firearms.

Six operations are performed at one time, resulting in the production of 80 completely broached barrels per hour (at 80% efficiency)!

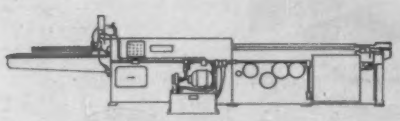
Do you think it paid off, for this revolver maker to convert to Lapointe Broaching? Examine the list of operations, shown below the photographs, and decide for yourself . . . (it won't take you long!) Then, think of some of the operations you are now performing in your plant, and see how easy it would be for you to *lower your own costs through conversion to Lapointe Broaching.* On request, a qualified Lapointe field engineer will gladly discuss the subject with you.

THE LAPOINTE MACHINE TOOL COMPANY

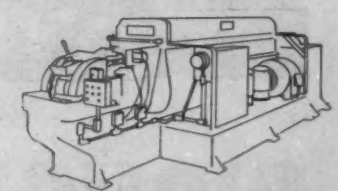
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

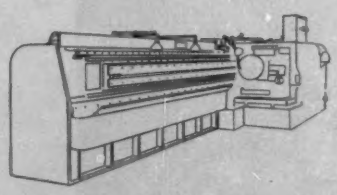
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC

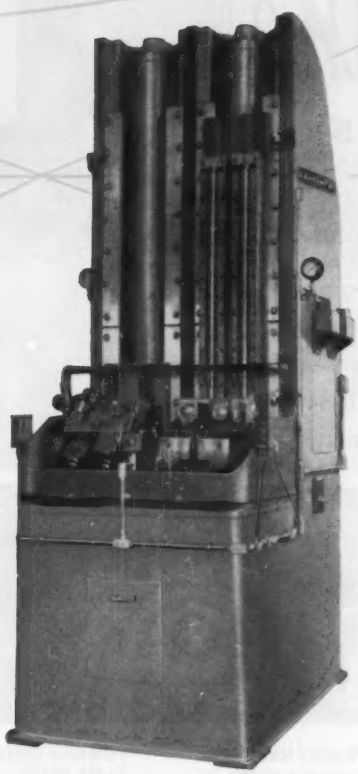


SRHE SINGLE RAM HORIZONTAL, ELECTRIC

. . . . . in LAPOINTE

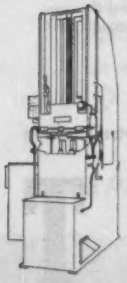
BROACHING

LAPOINTE takes all the responsibility for your ***continuous broaching*** program. We build the broaching machines, build the broaching fixtures, and make the broaches!

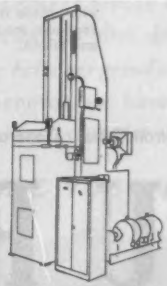


Operations: Broach half-round and adjacent parallel sides lengthwise; broach bottom contour crosswise; straddle-broach bottom lengthwise, and straddle-broach end in same pass, part being indexed 90° mid-way of the cutting stroke; broach slot at an angle across the end. Special mid-stroke indexing of part in the fixture at this point permits two cuts to be made at right angles to each other without removing the part from its nest. Part is broached from rough contour steel forging.

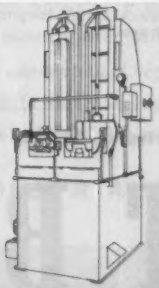
Machine is Lapointe 10-ton 66-inch stroke Double Ram Vertical Surface Broaching Machine, with two operations assigned to each Tip-Down Table (Lapointe patent).



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

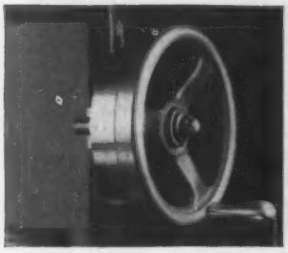
BROACHING

For more information fill in page number on Inquiry Card, on page 231

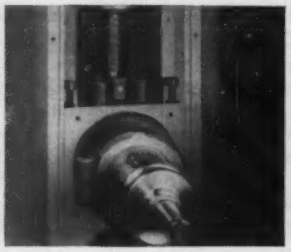
FOOTBURT

Accurate grinding for small parts

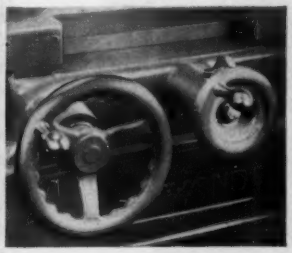
■ The Hammond No. 2, 6″ x 18″, Surface Grinder is a precision tool room machine for use on the most accurate gauge and tool work. The standard spindle is direct motor driven and is mounted on precision preloaded ball bearing. Total vertical adjustment is 10¾″. In and out movement of table is 6½″ with a longitudinal travel of 18″.



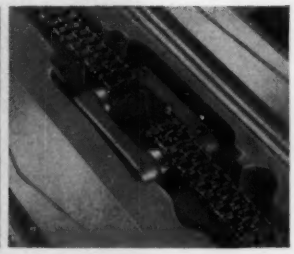
ACCURATE SPINDLE ADJUSTMENT—Standard vertical adjustment of spindle through handwheel is .0005″. With Vernier attachment, spindle can be raised accurately to .00005″.



SOLIDLY SUPPORTED SPINDLE CARRIER—Spindle carrier is moved vertically on double dovetail ways with adjustable tapered gibs.



CONVENIENT HAND CONTROL—Handy wheels for cross travel, accurately gauged to thousandths, and quick acting longitudinal travel.



SMOOTH ROLLER CHAIN TABLE DRIVE—Remarkably smooth finish on work without chatter marks frequently found when table is moved by conventional means through rack and pinion.

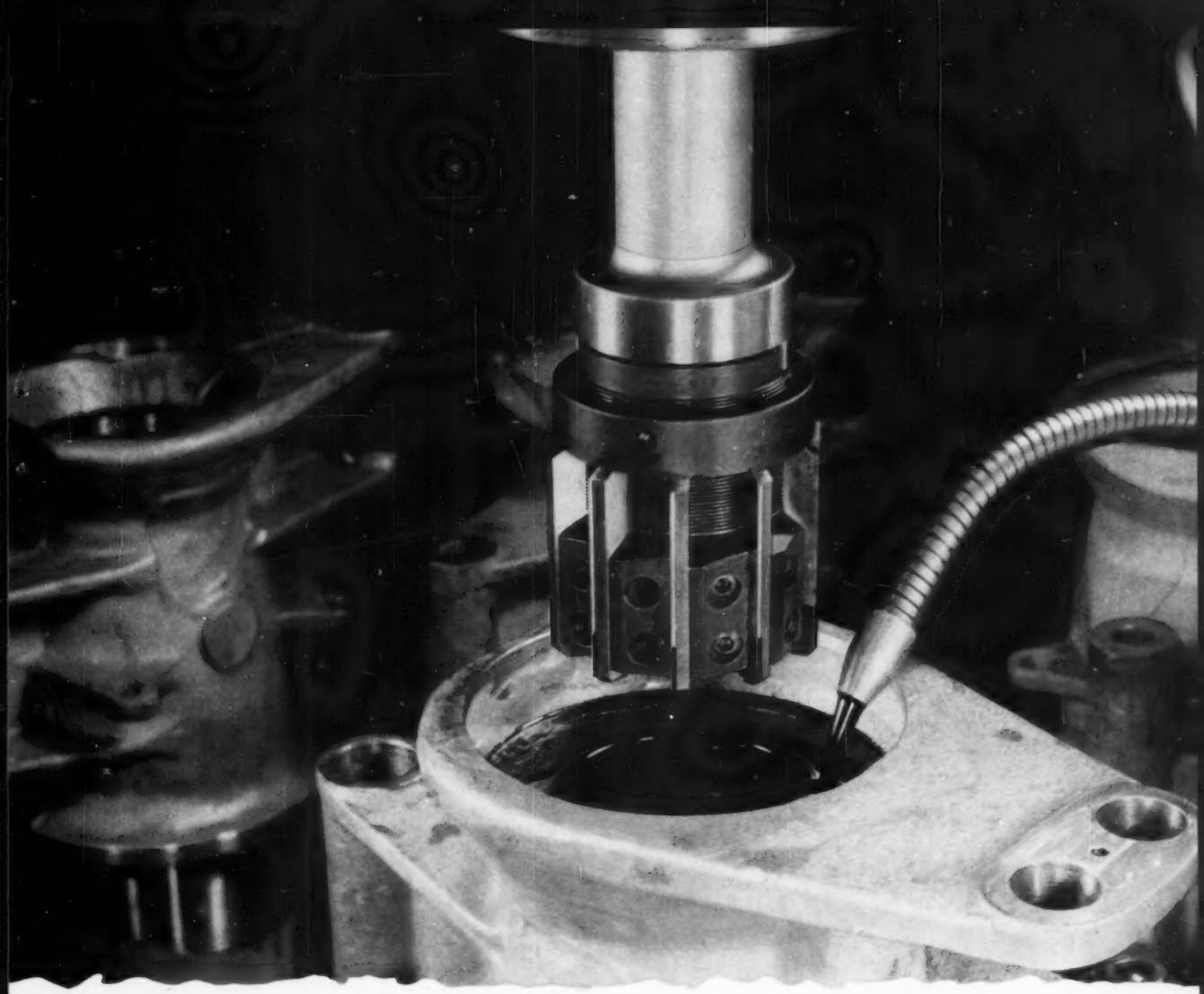
Write or wire for further information.

THE FOOTE-BURT COMPANY • **Cleveland 8, Ohio** • Detroit Office: General Motors Building

FOOTBURT

SURFACE GRINDING

For more information fill in page number on Inquiry Card, on page 231



TOOL LIFE INCREASED 400%

CLEVELAND Carbide Tipped Adjustable Reamer sets new high record!

The specifications on this job call for reaming a 4½" hole to a tolerance of .001" and a surface finish of less than 50 R.M.S. (micro-finish). CLEVELAND Carbide Tipped Adjustable Reamers are meeting these requirements day after day... month after month... *and reaming five times as many holes per grind as the conventional high speed reamers formerly used.*

Whenever *you* have a difficult reaming problem, a CLEVELAND Service Representative can help you. Contact our nearest Stockroom, or...

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

Request your copy of this descriptive booklet on CLEVELAND Carbide Tipped and Solid Carbide Cutting Tools

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

E. P. Barrus, Ltd., London W. 3, England

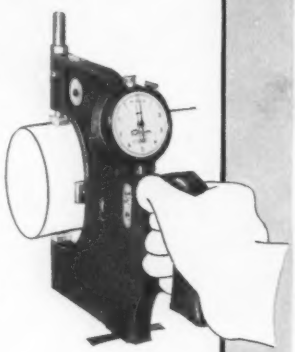
Choose the Gage that's RIGHT for YOUR job!

There's a STANDARD® Dial Snap Gage That Fits Your Particular Requirements... Precisely

Paralloc®

STANDARD's Paralloc anvil locking mechanism maintains parallelism of anvil faces to an unusually high degree of accuracy

L TYPE...



For tough, long run jobs or those involving deep, narrow places

Gages close to shoulders

Flat anvils, faced with tungsten carbide, ideal for close tolerances

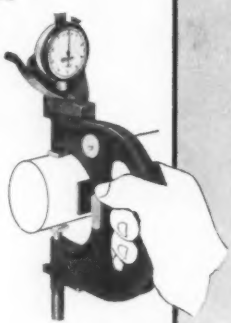
Indicator fully guarded, conveniently placed for easy reading

Sizes up to 14"

Wide range of indicators

D TYPE...

With Paralloc anvil locking mechanism and tungsten carbide faced flat anvils



Lower initial cost

Gages close to shoulders

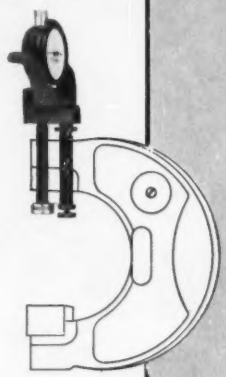
Suitable for long runs where side clearance and forward position of indicator are not important factors

Sizes up to 8"

Wide range of indicators

Dializers®

STANDARD Dializers provide an economical, effective means for converting your AGD Adjustable Limit Snap Gages to Dial Snap Gages.



Fit your present AGD frames of any make, or, if desired, we can supply frames up to 26⅝"

Dializers can be easily installed and transferred from one frame to another

Has radiused contact

The easy way to gain greater efficiency with greater economy

SF SERIES...

Designed for situations where low cost is an important factor and requirements do not suggest need for Paralloc models.

Light weight, sturdy, special aluminum frame

Fitted with Dializer

One contact radiused

Long range of adjustment

Easily adaptable to many jobs

Sizes to 13½"

Write for details on any or all of these models

STANDARD GAGE COMPANY, INC.

MEASURING INSTRUMENTS FOR PRECISION INDUSTRY

132 PARKER AVE. POUGHKEEPSIE, N. Y.

STANDARD® Gages

For more information fill in page number on Inquiry Card, on page 231

how MIEHLE reduces their cost savings opportunities to careful analysis

Statement from the MIEHLE PRINTING PRESS & MANUFACTURING CO.

"Near the end of each fiscal year, a plant survey is made by production and plant engineering personnel. Worn or obsolete machinery, as well as contemplated additional machinery, is listed and a budget of estimated expenditures for the ensuing year is prepared. This budget is written in detail, giving description and estimated cost of each item. Before the purchase of any item for cost reduction is authorized, it is subjected to analysis under the MAPI formula."

F. M. BENDER
Vice President
Manufacturing

MIEHLE PRINTING PRESS & MFG. CO. FORM-EXHIBIT I

CAPITAL EQUIPMENT REPLACEMENT ANALYSIS

DATE: 10-26-55
ANALYSIS NO. 29
WORKS Chicago

1 SUBJECT OF ANALYSIS Replace Grinder with 10 x 72
2 ANTICIPATED RATE OF PRODUCTION Two shift operation throughout the year
3 Plain Hydraulic Grinder

	PROPOSED EQUIPMENT	EXISTING EQUIPMENT
4 DESCRIPTION:	10 x 72 Plain Hydraulic Grinder 18 HP	MACH. NO. 1921 DESCRIPTION: Grinder 20 HP
5 6 EST. PRIMARY SERVICE LIFE:	15 YRS	YEARS OF LIFE TO DATE: 25
7 EST. TERMINAL SALVAGE VALUE = (X) =	$ 3500.00	INSTALLED COST $400.00
8 EST. COST INSTALLED=(Y)=	$ 30,900.00	LOCATION: Lathe DEPT. NO.
9 TERMINAL SALVAGE FACTOR = x/y =	11.4%	INTENDED DISPOSAL Resale RESALE, SALVAGE OR CONVERSION VALUE $ 500.00

	FACTOR	PROPOSED EQUIPMENT	EXISTING EQUIPMENT
10	DIRECT LABOR (FOR ANTICIPATED PROD.)	$ 11,440.00	$ 16,300.00
11	INDIRECT LABOR (FOR ANTICIPATED PROD.)	341.00	815.00
12	DEFECTIVE MATERIAL SPOILAGE, SCRAP		1,000.00
13	DOWN TIME:	611.00	1,000.00
14	POWER CONSUMPTION:		
15	TOOLING:		5h.00
16	SUPPLIES:	309.00	600.00
17	FLOOR SPACE:(if usable)	78.00	
18	PROPERTY TAXES & INSURANCE:		
19	NORMAL MAINTENANCE:		
20	SPECIAL REPAIRS:		
21	SUB CONTRACT COSTS:		
22	OTHER ITEMS(explain on reverse side):		
	TOTALS:	$ $ 12,801.00 →	A $ 19,769.00
			B $ 12,803.00
			C $ 6,966.00
23			
24			
25	NEXT YRS. VARIANCE IN OPERATING COST:(A MINUS B):		D $ 750.00
26 27	(NEXT YRS. CAPITAL COST OF RETAINING EXISTING EQUIPMENT) RESTORATIVE REPAIRS $ 2500.00 ÷	(RESTORATIVE REPAIRS $ 2500 X 10%)	E $ 50.00
28	YEARS EFFECTIVE 5		F $ 100.00
29	RESTORATIVE VALUE RESALE, SALVAGE or CONVERSION VALUE OF EXISTING EQUIPMENT $ 500	X 10%	G $ 7,866.00
30	NEXT YEAR SALVAGE VALUE LOSS,	EST. COST INSTALLED(C+D+E+F)	H $ 5,620.00
31	TOTAL NEXT YRS. COST FOR EXISTING EQUIPMENT		
32	TOTAL NEXT YRS. COST FOR PROPOSED EQUIPMENT CHART 8.2 % + INT. 10% TOTAL 18.2 %	$ 30,900.00	$2,246.00
33	FIRST YRS. GAIN (+) OR LOSS (-) THRU REPLACING EXISTING EQUIPMENT & 10% RETURN ON INVESTMENT) (TAKING INTO ACCOUNT DEPRECIATION, LOSS OF EFFICIENCY & (G-H)		

CALCULATED BY _____ DATE 10-26-55
APPROVED BY: _____ DATE _____
(USE REVERSE SIDE FOR CALCULATION)

* **GAIN** from replacement by the Miehle formula is . . . after required interest or return on the new investment . . . after full allowance (by the formula) for future obsolescence of the new equipment.

Keep gathering metal-working production ideas . . . be well informed when you replace machinery . . . . .

ROCKFORD INSERT GROUP

Sept. 1956

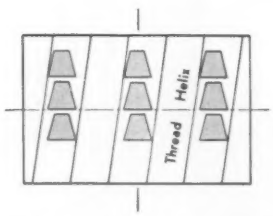
BARBER-COLMAN offers

thread milling requires accurate cutter design!

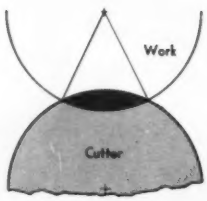
mathematical computation of cutter form

Multiple thread milling cutters often produce a thread space form which is not a duplicate of the cutter tooth form. The cutter tooth form is not a duplicate because the cutter tooth rotates in a plane which is perpendicular to the work axis and at an angle to the thread helix. This generating action produces a fillet at the bottom of the threads, and a thread space which is wider than the cutter tooth. When the amount of generating produces an unsatisfactory thread form, the cutter must be developed to produce the desired thread tooth thickness without fillet interference.

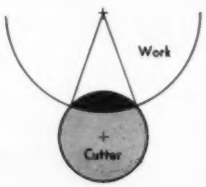
Whenever required, Barber-Colman engineers, by mathematical computation, design the correct cutter which compensates for the generating action. In this computation, the diameter of the cutter is very important since the amount of tooth form correction increases as the diameter of the cutter increases. A thread produced by a specially-developed cutter will have an accurate form which will fit the gage with the desired bearing.



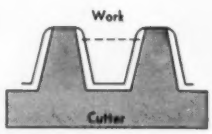
This schematic drawing shows how a multiple thread milling cutter produces a thread space which is wider than the cutter tooth. The cutter is set so that the plane of rotation of the cutter teeth is perpendicular to the work axis, and at an angle to the thread helix.



Large diameter cutters have greater length of contact and produce more pronounced fillets.

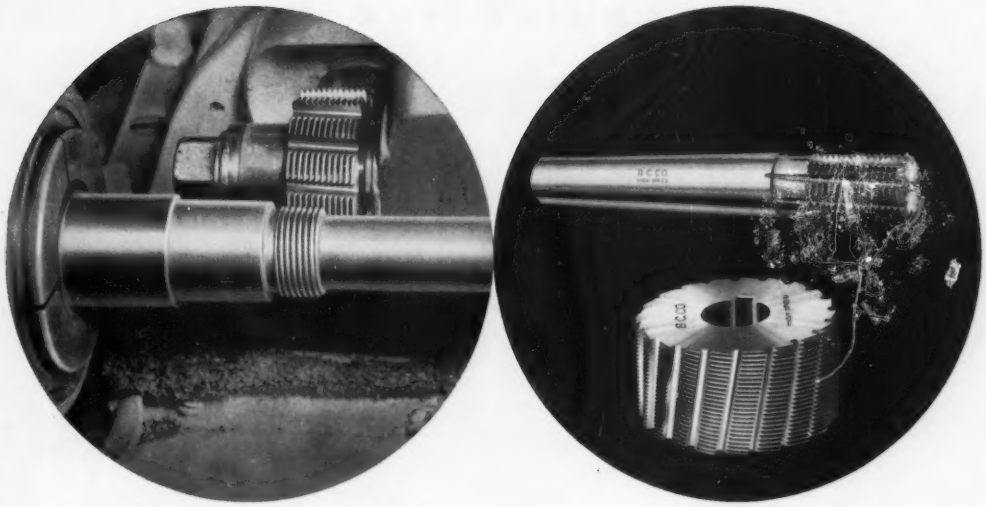


Small diameter cutters have less length of contact and produce smaller fillets.



In some cases, cutters mill deeper than true thread form. Any generated fillets which may be cut are then below the gaging surface of the thread. Correct cutter design takes care of this automatically.

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



original cutter accuracy in resharpening

All Barber-Colman form-relieved milling cutters are accurately index-sharpened on Barber-Colman automatic sharpening machines, so that all cutter teeth are the same height and accurately spaced. This makes it easy to maintain original cutter accuracy when resharpening either on automatic sharpeners, or on conventional sharpening equipment using the accurately indexed cutter teeth as a reference. In either case, accurate sharpening to original tolerances is easily maintained, and cutter sharpening time is reduced to a minimum.

design elements for maximum performance

With the proper tooth form developed to cut accurate threads, the engineers then analyze the job conditions to determine which cutter features will produce best cutter performance. These features include selection of the proper cutter material, shell or shank type cutters, straight or helical flutes, rake teeth, axial relief and intermittent teeth if sharp threads are desired. Since we make all classes of ground and unground thread milling cutters, we can recommend the cutter accuracy required for your job.

When you have a threading problem, consult Barber-Colman cutter engineers for their recommendations on the proper cutters for the job. Be sure the cutters you have are accurately designed to cut the correct thread form. Send us blueprints of your threaded parts for quotation on thread milling cutters designed to produce correct threads.

BARBER-COLMAN COMPANY

829 ROCK STREET • ROCKFORD, ILLINOIS

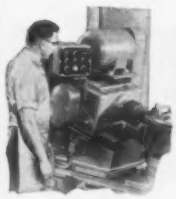
Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

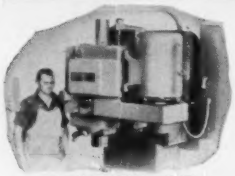
From Elements Like These

Together with SUNDSTRAND "Engineered Production"



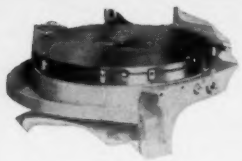
TRAVELING HEADS

Self-contained units with ways for horizontal or angular travel.



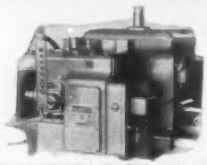
VERTICAL OR HORIZONTAL HEADS

Available in capacities from 3 to 100 H.P.



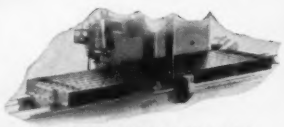
ROTARY TABLES

Available in several sizes for continuous or rotary milling operations.



ADJUSTABLE COLUMNS

Movable columns provide maximum cutting rigidity for horizontal heads over a wider range for milling both large and small work pieces.



HORIZONTAL TABLES

Available in widths from 10½" to 96" and feed strokes from 18" to 216".

ALL ANGLE HEAD

Available up to 25 H.P.

...You'll get the exact machine for your requirements

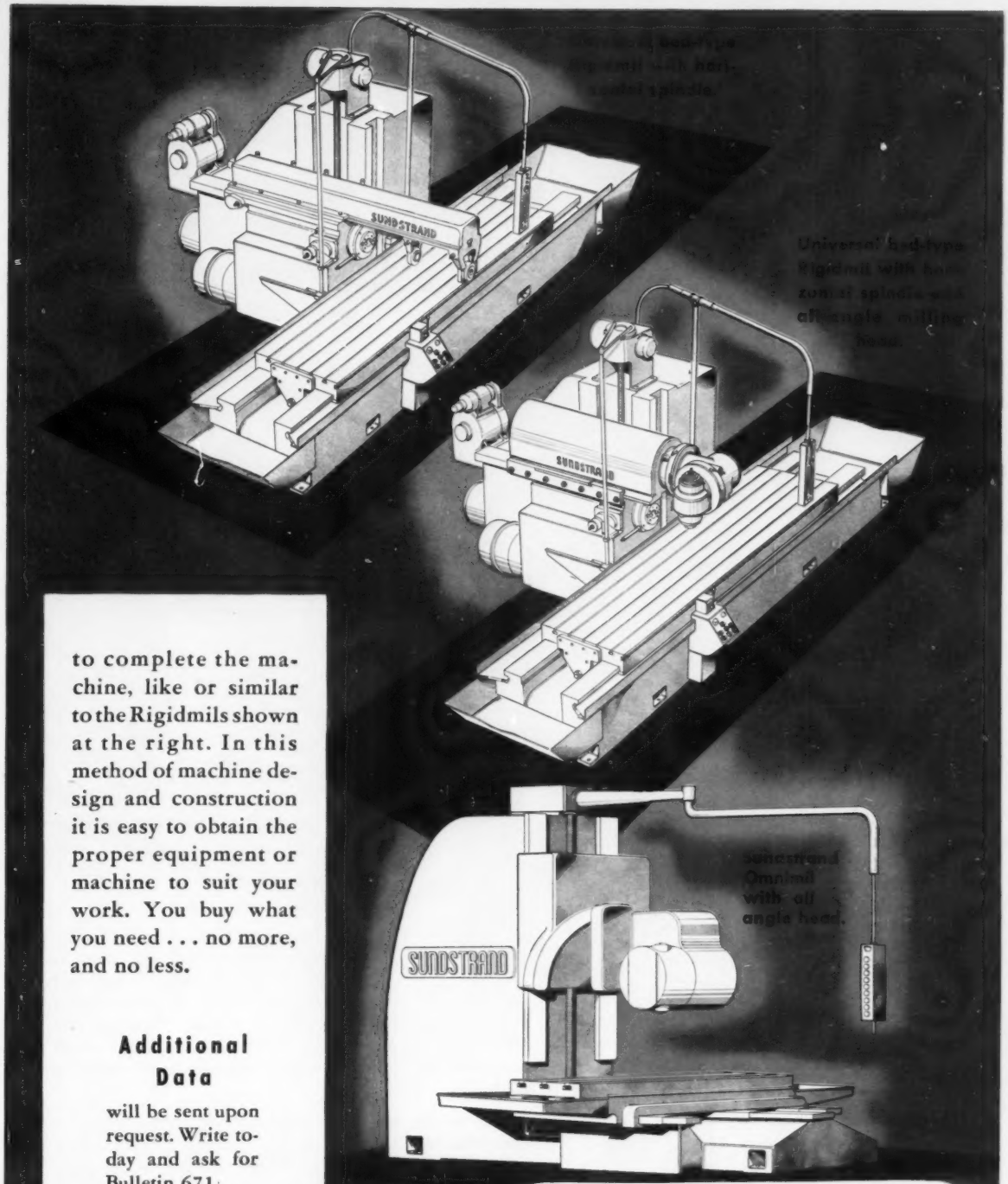
Sundstrand Rigidmils are built from standard machine elements as shown above. After the correct tooling for the job has been determined, the proper combination of machine elements is assembled

SUNDSTRAND "Engineered Production" Service*

*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

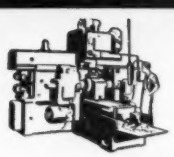


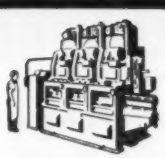
to complete the machine, like or similar to the Rigidmils shown at the right. In this method of machine design and construction it is easy to obtain the proper equipment or machine to suit your work. You buy what you need . . . no more, and no less.

Additional Data

will be sent upon request. Write today and ask for Bulletin 671.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





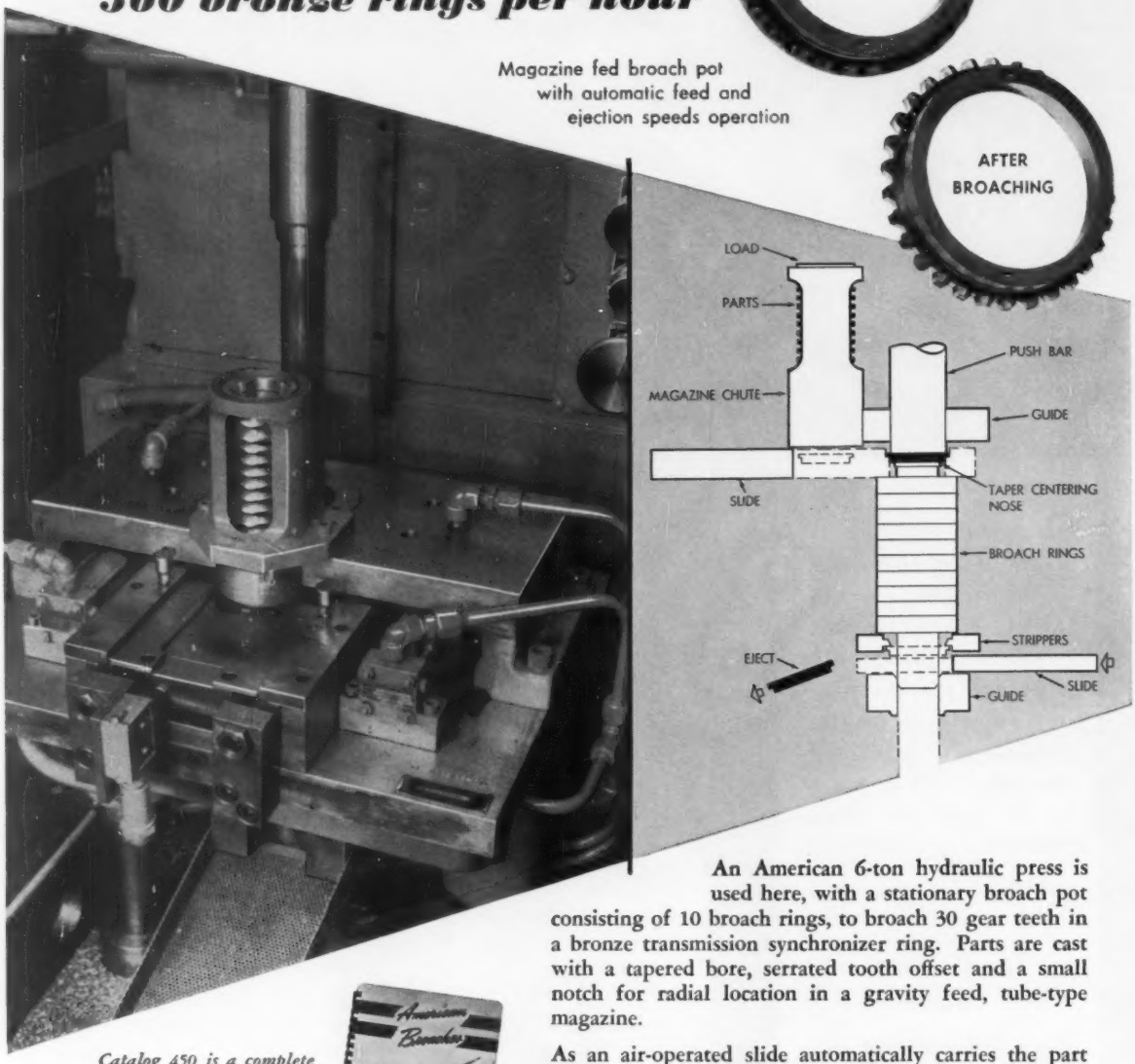
SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

ANOTHER *American* FIRST

30 gear teeth broached
IN EACH OF
360 bronze rings per hour

Magazine fed broach pot with automatic feed and ejection speeds operation



An American 6-ton hydraulic press is used here, with a stationary broach pot consisting of 10 broach rings, to broach 30 gear teeth in a bronze transmission synchronizer ring. Parts are cast with a tapered bore, serrated tooth offset and a small notch for radial location in a gravity feed, tube-type magazine.

As an air-operated slide automatically carries the part into broaching position, the ram of the press descends and a push bar, engaging the tapered bore of the part, forces it through the broach pot. During the cutting operation the push bar is guided above and below the broach pot. Stripper fingers remove the part as the push bar returns. Ring is ejected by a second slide.

Catalog 450 is a complete and interesting manual on all types of broaching. Write for your copy today.

AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

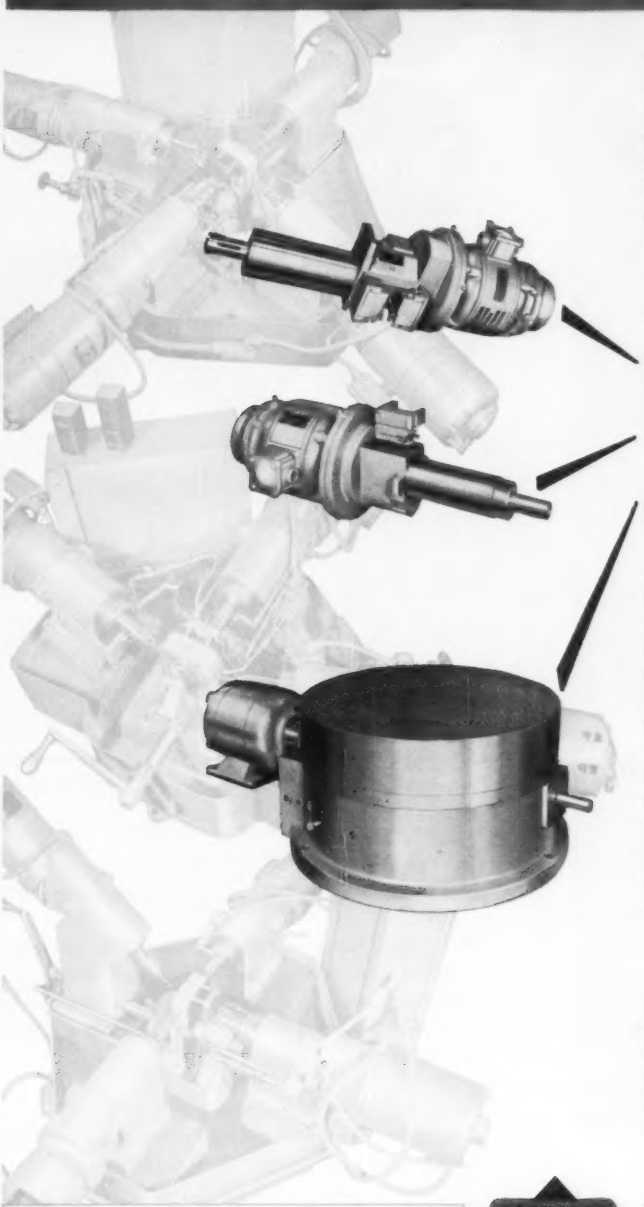
American Building - Ann Arbor, Michigan

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

MAKE YOUR OWN
SPECIAL PRODUCTION MACHINE TOOLS
WITH R-J UNITS



These Drill, Tap, and Index Units are so designed that they can be easily engineered into any simple and sturdy supporting structure. The Drill and Tap Units flange mount into straight bored holes, the Index Units bolt down to a flat surface. Our Data Sheets give complete dimensions, full specifications, and recommended capacities.

all-mechanical

DRILL UNITS
TAP UNITS
INDEX UNITS

All functions of R-J Units are fully mechanical, easily understood, and convenient for maintenance. They are completely reliable, as they have been integral parts of our special production machines for many years, and will continue to be. We make these units available as separate units, because we realize you have many occasions when you might want to add to an existing machine, make up a new multiple-operation job (such as the three little ones illustrated), or replace a unit to take care of engineering changes. All units meet JIC specifications (or can be provided with direct motor drive).

FREE BOOKLET

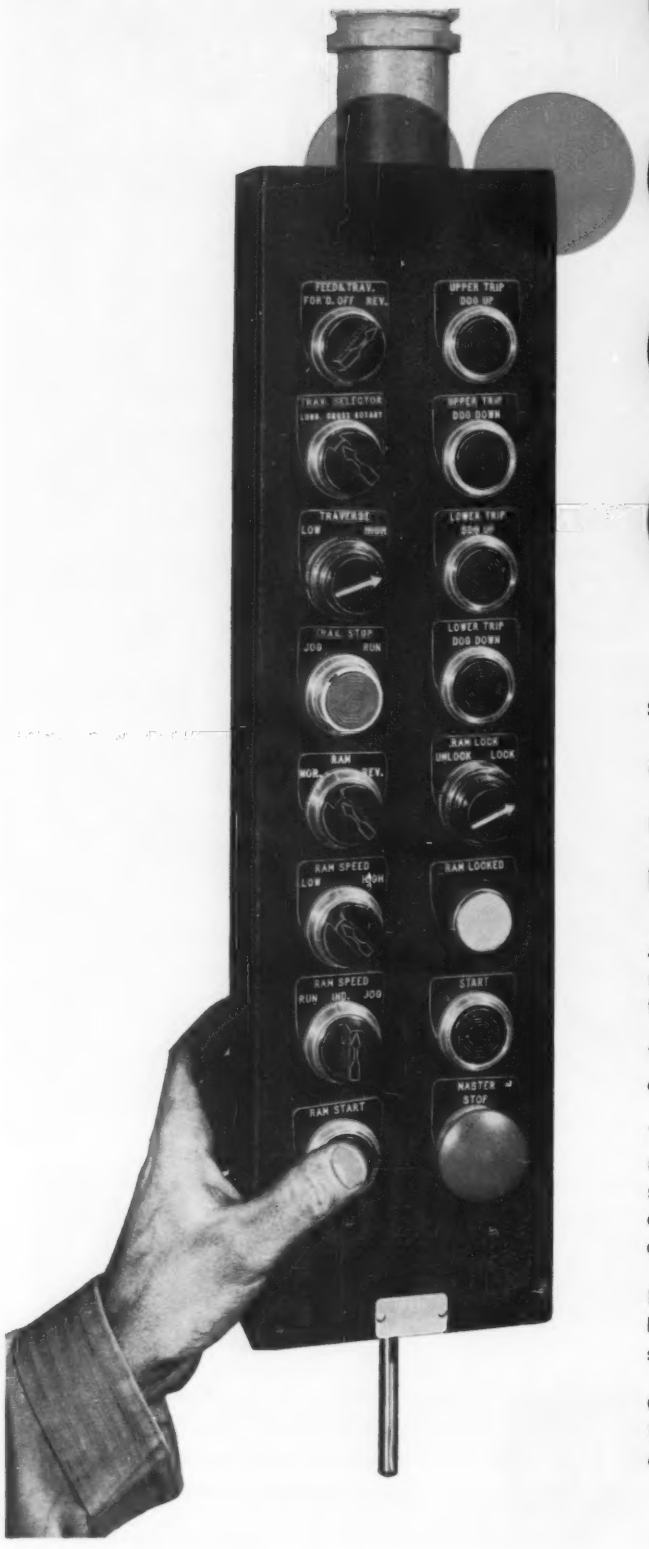
Write for this free "Manual" today. It contains data sheets and wiring diagrams of all Units. Also there are a score or more of reprints from advertisements, showing and describing typical R-J machines, and illustrating various methods of adapting the Units for various operations. Ask for the "R-J Unit Manual."

REHNBERG-JACOBSON
MANUFACTURING CO.
ROCKFORD, ILLINOIS

R-J

DESIGNERS, ENGINEERS
MANUFACTURERS AND
PRODUCTION CONSULTANTS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



push button control

speeds operation and set-up on new Rockford **hydraulic** slotter

All longitudinal, transverse and rotary movements are selected and operated from the push button station of this new Rockford hydraulic Slotter.

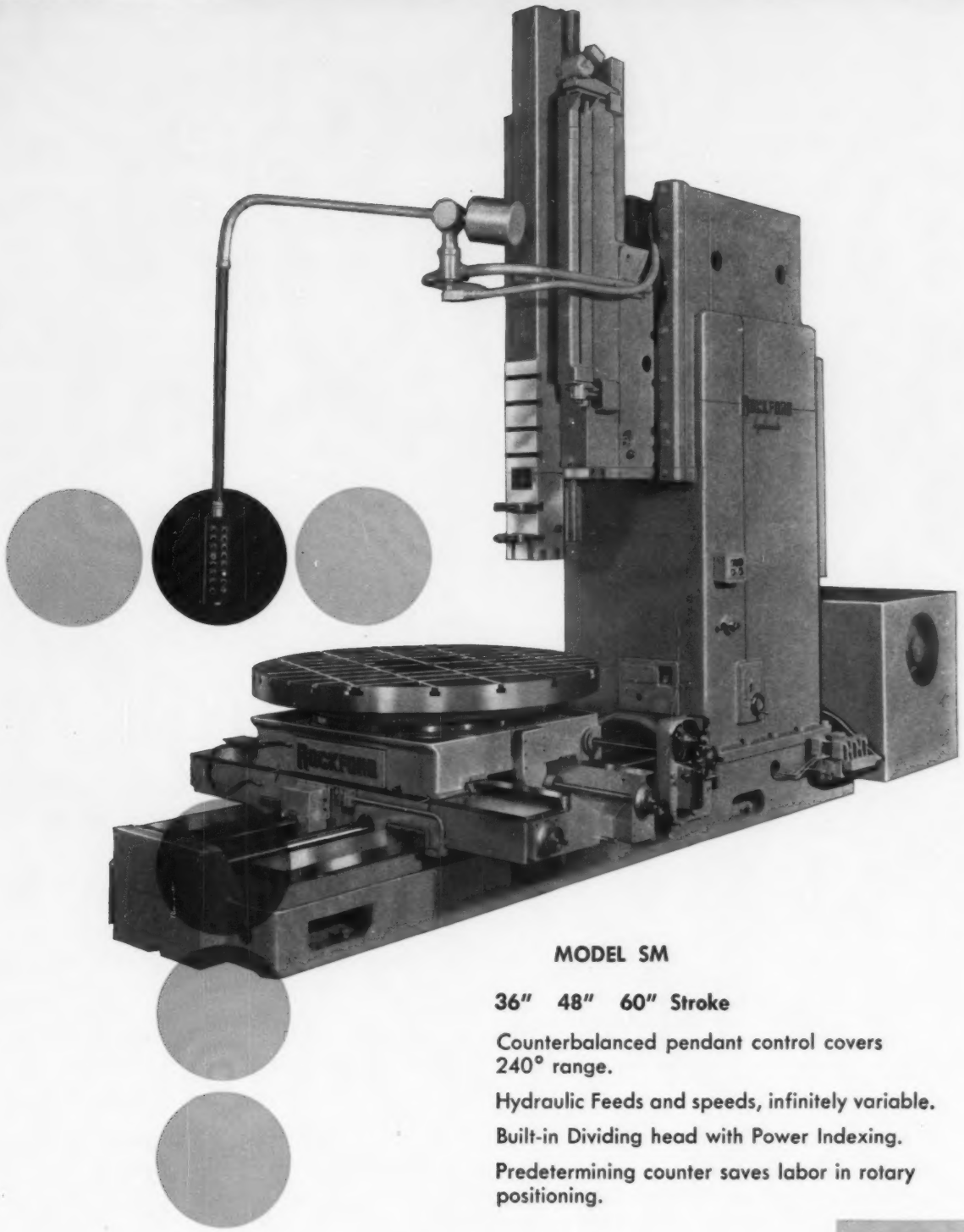
The ram lock is pendant operated and ram stroke length and position are completely push button controlled.

Two-speed table traverse is available, enabling the machine operator to position the work to a few thousandths, without manual movements, although manual control of all movements is available from either side of the machine.

Full hydraulic drive provides two cutting ranges, one for high speeds and low cutting forces; the other for slow speeds and heavy cuts.

Get full details on this new hydraulic slotter from any Rockford Machine Tool Co. representative, or write directly to us.

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



MODEL SM

36" 48" 60" Stroke

Counterbalanced pendant control covers 240° range.

Hydraulic Feeds and speeds, infinitely variable.

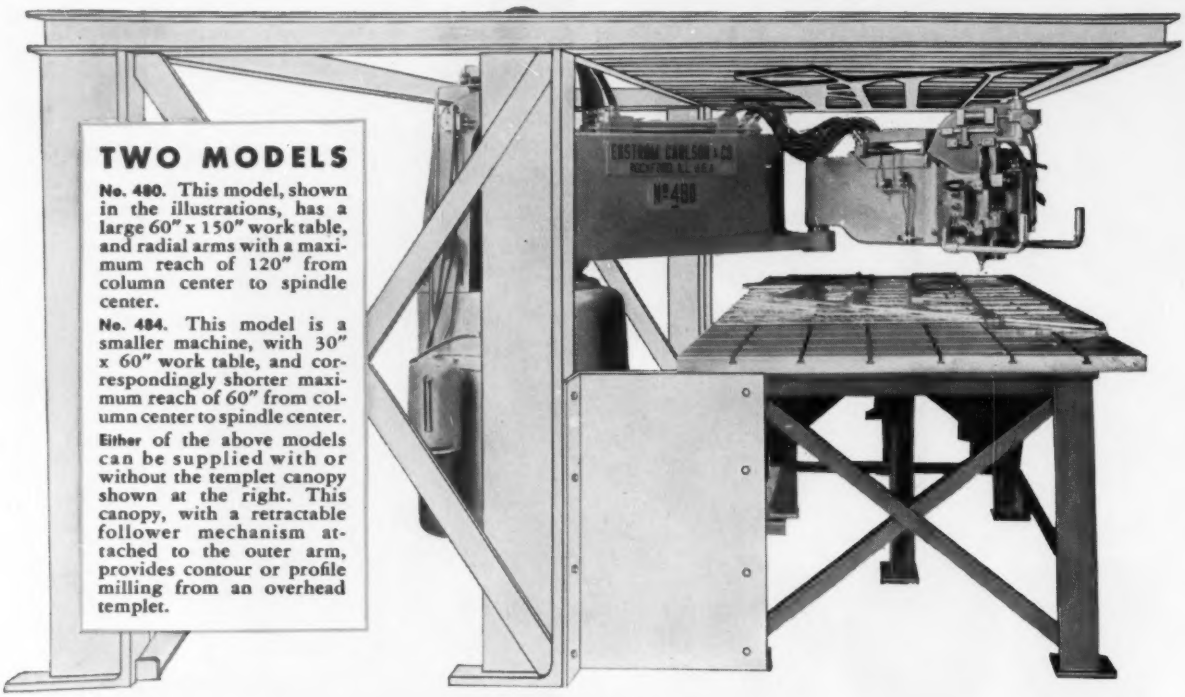
Built-in Dividing head with Power Indexing.

Predetermining counter saves labor in rotary positioning.

ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

HYDRAULIC

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



TWO MODELS

No. 480. This model, shown in the illustrations, has a large 60" x 150" work table, and radial arms with a maximum reach of 120" from column center to spindle center.

No. 484. This model is a smaller machine, with 30" x 60" work table, and correspondingly shorter maximum reach of 60" from column center to spindle center.

Either of the above models can be supplied with or without the templet canopy shown at the right. This canopy, with a retractable follower mechanism attached to the outer arm, provides contour or profile milling from an overhead templet.

EKSTROM, CARLSON

RADIAL-ARM DEPTH AND CONTOUR MILLS

Manually-operated, radial-arm machines are recognized by airframe builders as the *fastest* and *most economical* for profile or contour milling. These new Ekstrom-Carlson profile milling and routing machines have the *additional* feature of *depth milling.* For low initial cost, low maintenance, and high production capacity, there is no other machine or method that will out-perform the new Ekstrom-Carlson No. 480 and No. 484.

NEW STANDARDS OF HIGH PERFORMANCE!

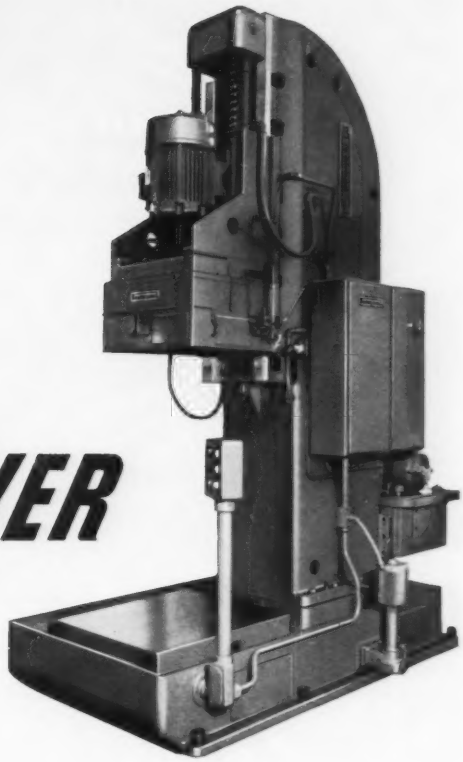
Outstanding machine-tool performance is due largely to important features: Rigidly designed base, column, and arm structures are machined to close limits for accuracy. Hydraulically-actuated cylinders, mist lubrication to motor bearings, independently operated follower and cutterhead assemblies with double slides, four-position depth stops with micrometer adjustments, water-cooled cutterhead motors, drawbar type collets, and many other valuable improvements. For details, write for data and specifications — or see your Ekstrom-Carlson representative.

EKSTROM, CARLSON & CO.

1400 RAILROAD AVE., ROCKFORD, ILL.
Machine Tools, Special Machines, Cutters
SINCE 1910

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 30—SUBCONTRACT PARTS



FAST CHANGEOVER

suits small-lot runs,
provides continuous operation on
BARNESDRIL
hydraulic-feed, way-type
drilling machines

Before you buy any drilling equipment, see these new BarnesdriL hydraulic feed Drilling Machines. Auxiliary Multiple spindle heads, with adjustable centers and slip plates, give you quick changeover to the number of spindles and drill patterns you need to meet production schedules on small runs. No costly set-up or loss of production time is necessary. By taking advantage of this flexibility and quick production changeover which these machines offer you can maintain continuous production operation with minimum cost per piece on a wide range of work.

This BarnesdriL machine is arranged with a 16-spindle auxiliary head, designed with adjustable center spindles and slip plates to employ any number of spindles in any pattern desired. The ease of changing production set-ups by substituting a new slip plate and fixtures keeps this machine operating full time on a high production basis.

these features keep maintenance costs low

Direct Motor Drive Eliminates Linkage
Ample Stroke Clearance for Easy Tool Change
Hydraulic Cylinder Serviceable without Dismantling Unit
All Valves Flange-Mounted
Hydraulic System is Manifold-Arranged

Ask for an estimate on processing your short run drilling operations, using these new BarnesdriL Machines. Send for a copy of Bulletin No. 700.

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

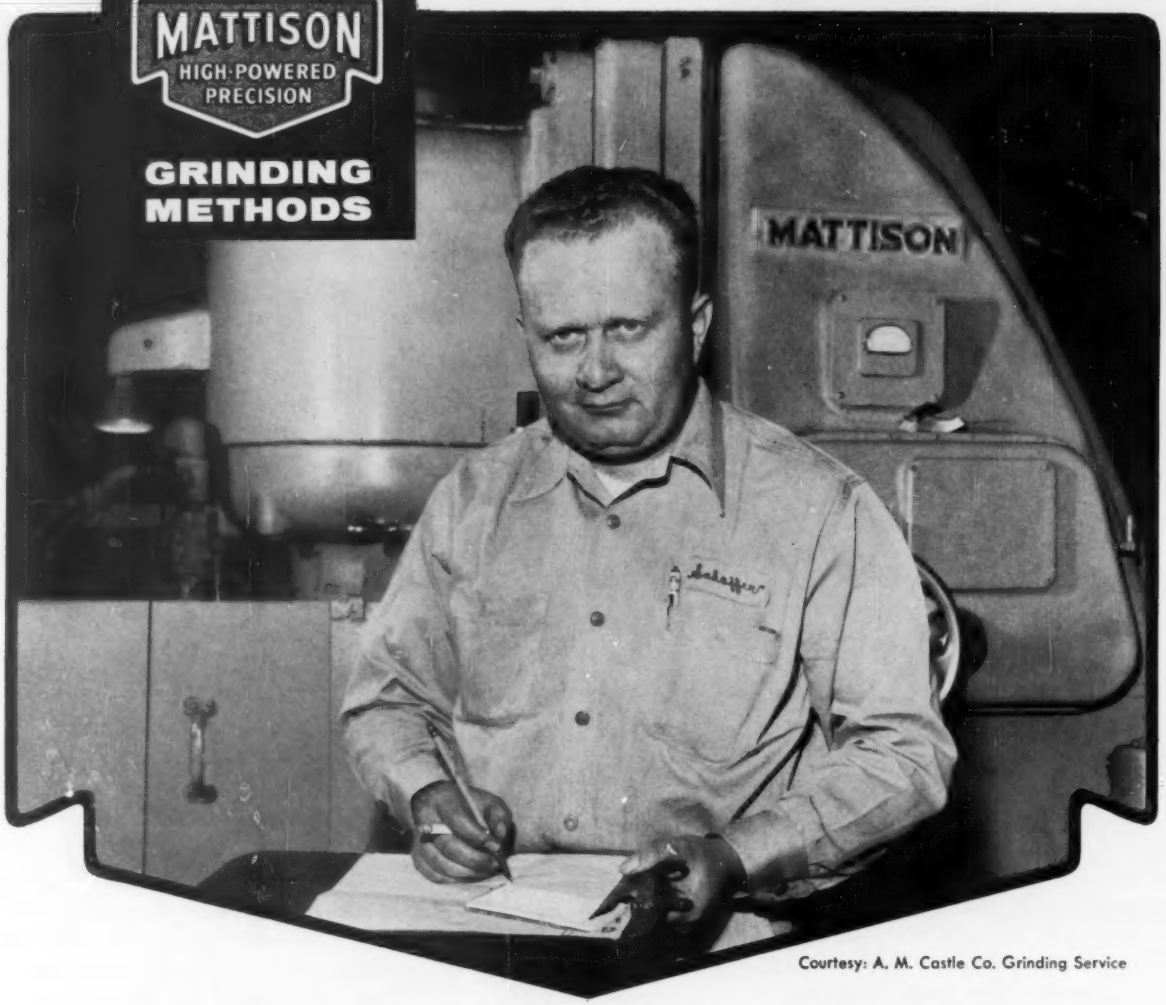
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 31—BROACH INSERTS

CASE HISTORY NO. 30—SUBCONTRACT PARTS

MATTISON
HIGH-POWERED PRECISION

GRINDING METHODS



Courtesy: A. M. Castle Co. Grinding Service

"Our Mattison Grinder cut man-hours in half, paid for itself in only a few months!"

In addition to flat, parallel surfaces, the Mattison is used to grind angles on a 10 in. x 30 in. sign plate for die makers.

Here's the report from A. M. Castle Co. Grinding Service, Los Angeles, on the performance of their Mattison No. 36 Vertical Spindle Rotary Surface Grinder:

"With this machine, we can beat any comparable piece of equipment for metal removal. Its ruggedness, ease of operation, and efficiency save us time and money. The machine cut our man-hours just about in half, and paid for itself in a matter of a few months."

The reason Mattison Grinders can be used for continuous operation and heavy stock removal is that they are extra heavy and rigid, permitting the use of higher horsepowers. Castle's machine, for example, is equipped with a 50 hp spindle motor, which produces high unit pressures when grinding large surfaces and assures positive cutting action. It is used continuously because it's so easily adjustable. And it can cut a convex or concave surface, then be reset to grind flat and parallel work in a matter of minutes.

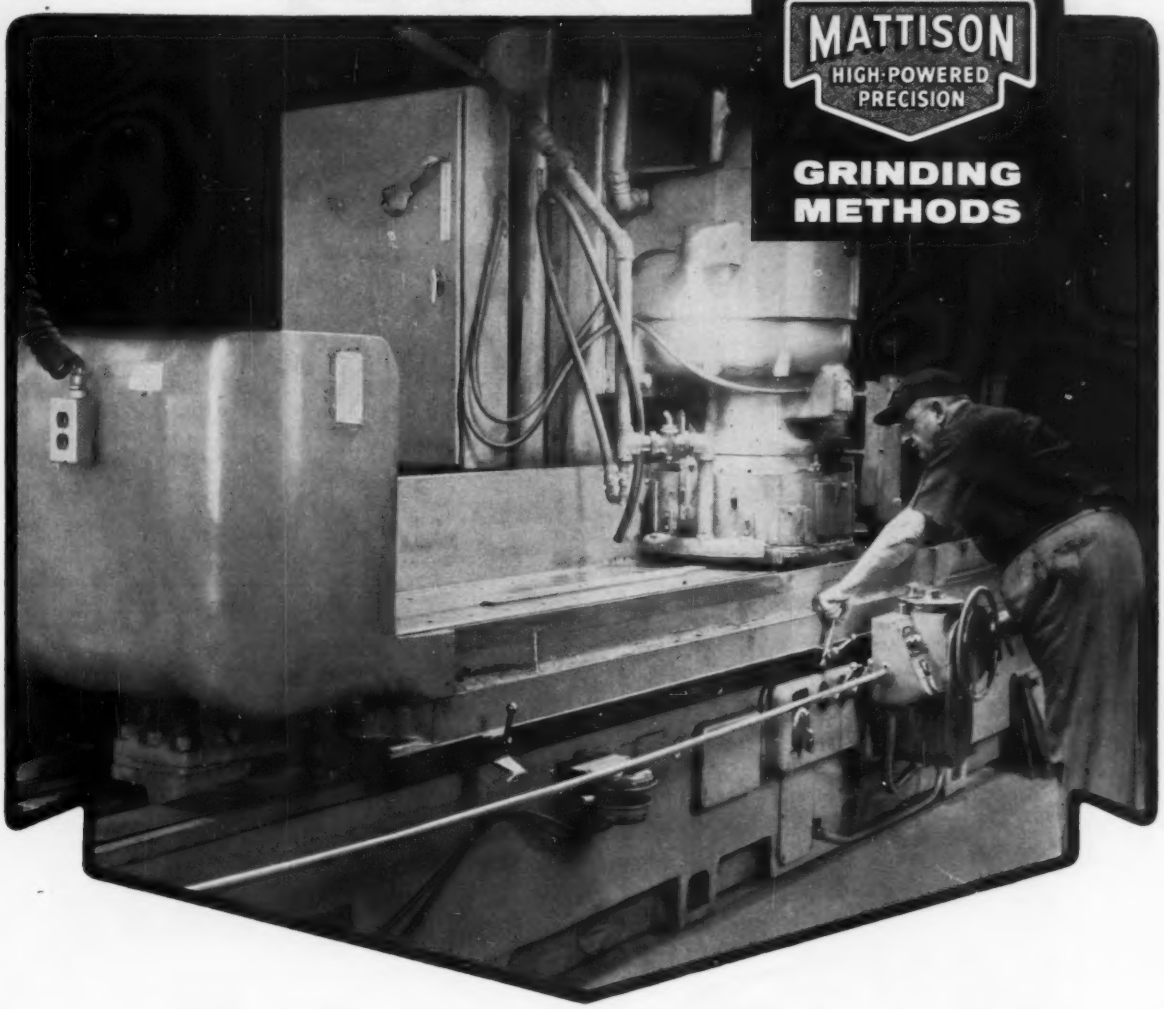
Call your Mattison dealer to arrange for a demonstration grind on your parts in the Mattison Methods Laboratory.

IF IT'S A FLAT SURFACE
THERE IS A MATTISON
TO GRIND IT

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 31—BROACH INSERTS

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS



Switch from planers to Mattison Grinder cuts setup time, boosts production 350 per cent!

Here's how high-powered surface grinding on a "Mattison" cuts costs in the plant of a large midwestern manufacturer of precision tools.

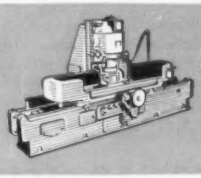
Broach inserts, formerly planed, are now ground on the Mattison No. 400 Vertical Spindle Reciprocating Table Surface Grinder. Production has been increased because this heavy, powerful machine removes so much stock, milling time has been reduced. Former production was 200 inserts per week on the planers—today inserts are ground at the rate of 700 per week (a 350 per cent boost). Whereas setup time was 45 minutes per load, today it takes only 15 minutes to set up and grind 20 pieces.

Mattison Grinders speed production because their rigid, one-piece column construction and high horsepower permit heavy stock removal. The wheel head holds its adjustment, yet can be tilted easily and quickly for the individual job. This assures flexibility for handling a wide range of work.

Check savings available in your plant by sending parts to the Mattison Methods Laboratory for free sample grind and production estimate. Your Mattison dealer will make all the arrangements.

Mattison high-powered Surface Grinder also is used for grinding large 60 in. clamping fixtures for the toolroom.

MATTISON MACHINE WORKS ROCKFORD, ILL. U.S.A.



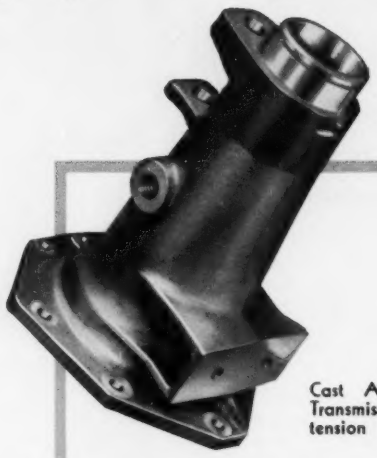
HIGH-POWERED PRECISION SURFACE GRINDERS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

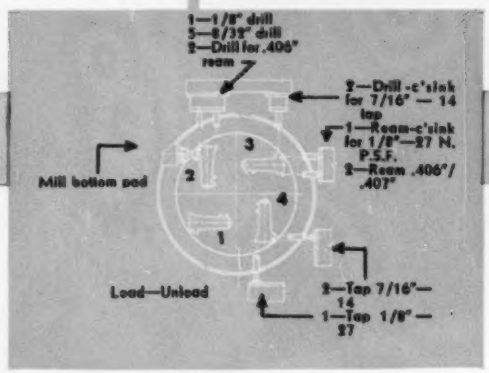
118 *Pieces per hour* 35 *Operations....*

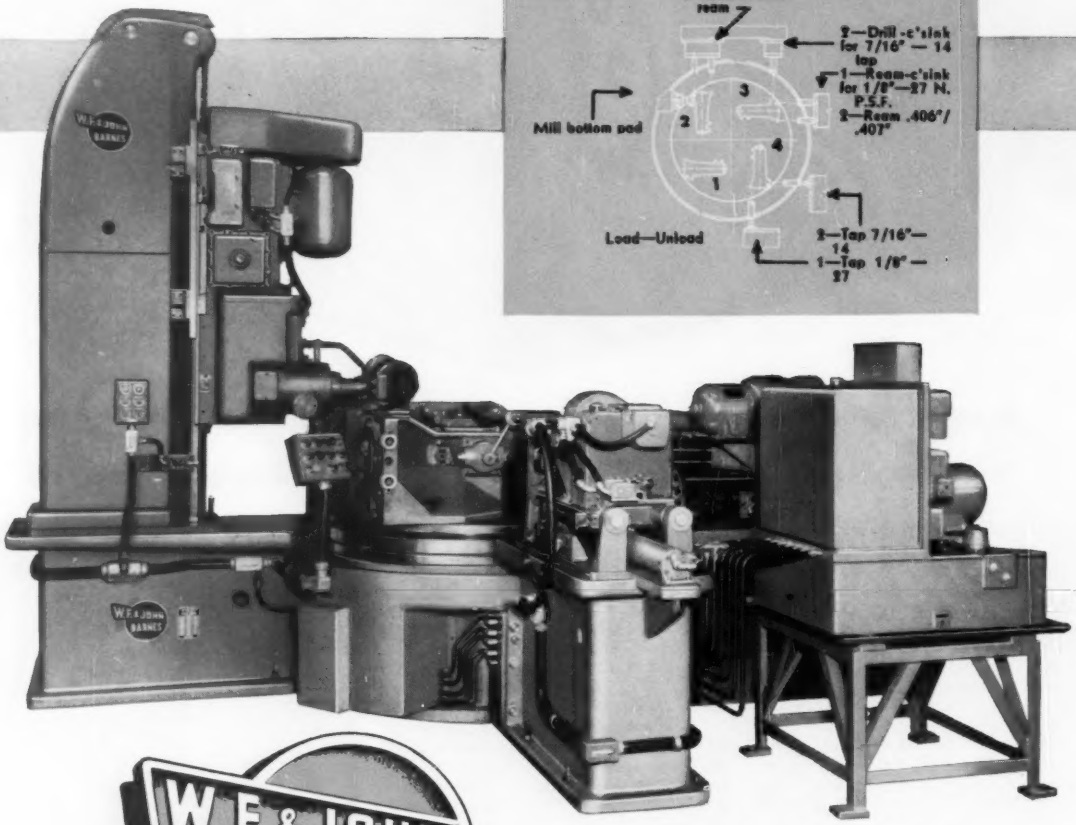
TRANSMISSION EXTENSIONS MACHINED TO CLOSE TOLERANCES ON COMPANION UNITS

Here is another typical example of how W. F. & John Barnes coordinated special machine engineering and building service helps solve complex machining problems. These two companion units, designed to machine cast aluminum automobile transmission extension housings, reduce production costs by combining operations. Note how the parts are positioned and the tooling arranged for efficient machining, and how the over-all design conserves floor space. The two machines perform 35 operations at the required gross production rate of 118 pieces per hour. Whether your production requires large or small machines, you'll find the coordinated services at Barnes can help you solve problems quickly and efficiently.



Cast Aluminum Transmission Extension Housing





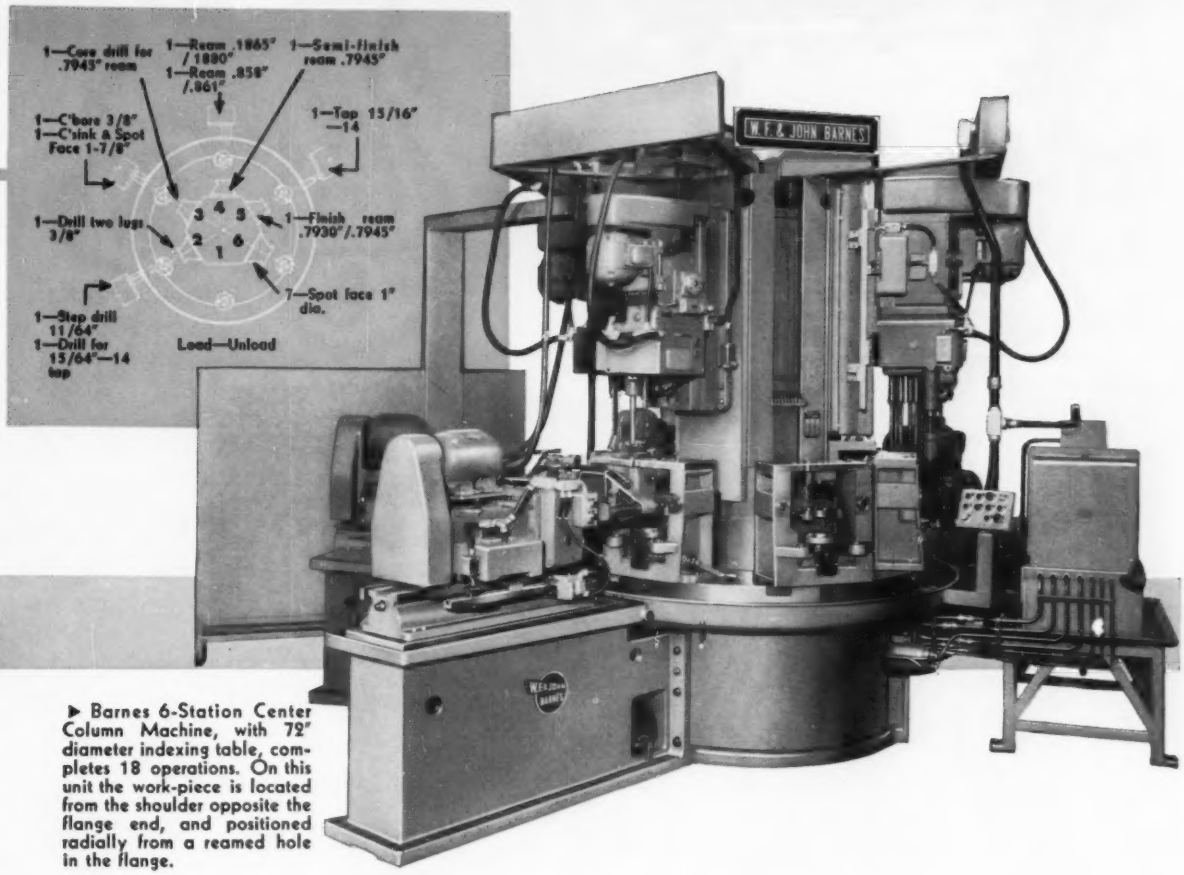
Barnes 4-Station Special Machine with 48" diameter hydraulically operated rotating table. This unit performs 17 operations. Vertical milling of bottom pad in Station No. 2 is completed with a retracting spindle. Fixtures locate part on end bores.

W. F. & JOHN BARNES COMPANY

MULTIPLE SPINDLE DRILLING • BORING • TAPPING MACHINES

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

. . . ON W. F. & JOHN BARNES SPECIAL MACHINES



▶ Barnes 6-Station Center Column Machine, with 72" diameter indexing table, completes 18 operations. On this unit the work-piece is located from the shoulder opposite the flange end, and positioned radially from a reamed hole in the flange.

BARNES SPECIAL MACHINE TOOL BUILDING SERVICE INCLUDES

1 **SPECIALIZED MANUFACTURING FACILITIES**—75-year background, large well equipped plant efficiently tooled to produce high production machines.

2 **SPECIAL HYDRAULIC EQUIPMENT**—designed and built to meet JIC standards. Individually engineered units assure smooth, dependable actuation for every requirement.

3 **SPECIAL ELECTRICAL EQUIPMENT and CONTROLS** — individually designed and built for maximum safety and ease of control with circuits that assure the most dependable coordination of all machine functions.

4 **SPECIAL GAUGES, FIXTURES, TOOLS** — designed for each individual machining problem, assure accuracy of operations at high production speeds.

5 **SPECIAL HANDLING AND CONVEYOR EQUIPMENT** — designed and built to reduce work handling, effect maximum safety and efficiency.

6 **COORDINATED DESIGN AND ENGINEERING** Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.

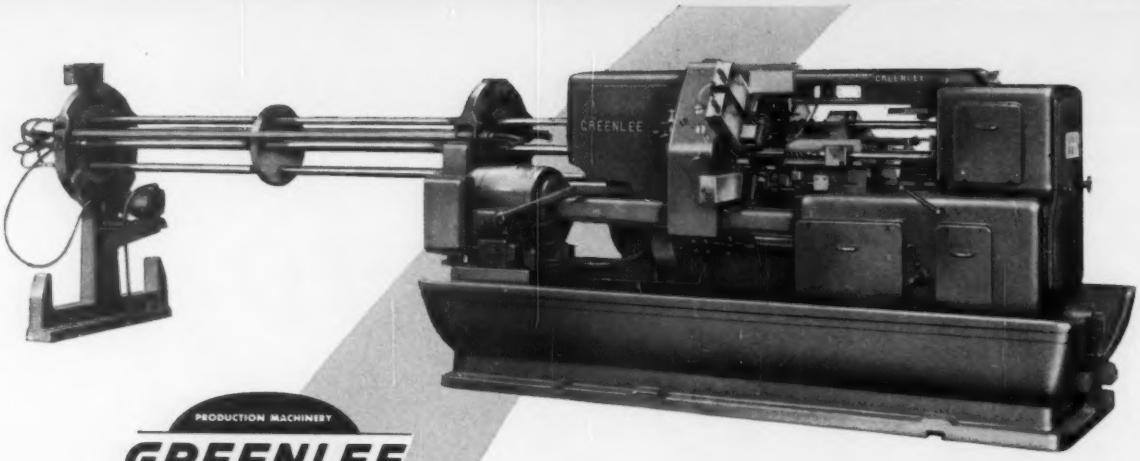
Write **FOR FREE DATA**

"Coordinated Machine Engineering" — a free booklet describing modern machines and mass production techniques. Write for your copy today.

402 S. WATER ST., ROCKFORD, ILLINOIS

AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



PRODUCTION MACHINERY

GREENLEE

AIR-FEED AUTOMATIC

1. **Permits Greater Job Versatility**
2. **Easily Adapted to Multiple Feedouts**
3. **Provides Longer Stock Feedout**
4. **Eliminates Stock Scoring**
5. **Reduces Stock Reel Noise**
6. **Eliminates Stock Pushers**
7. **Eliminates Feedout Cams**

Write today for Catalog A-405, or better still, have the Greenlee man call and show you the way to more profitable production with this air-feed automatic bar machine.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

GREENLEE BROS. & CO.

PRODUCTION MACHINERY
GREENLEE

1872 MASON AVE.
Rockford, Illinois

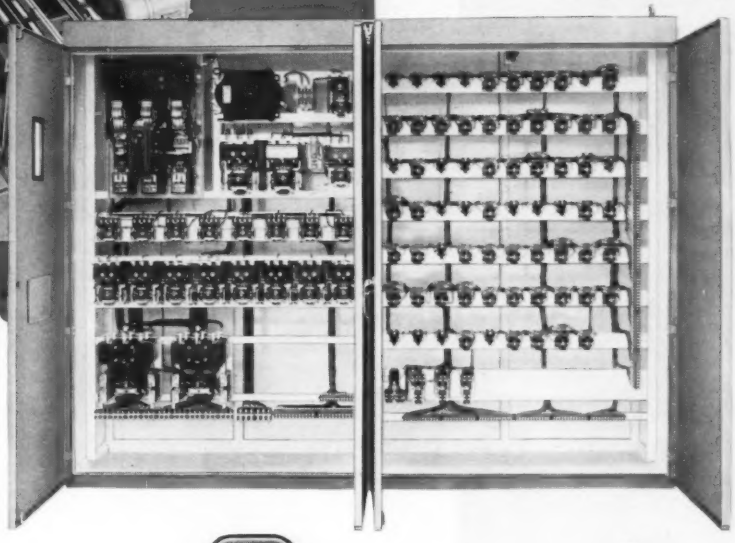
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

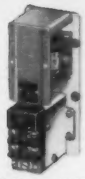
Satisfied Customers

RESULT FROM THE USE OF

Trouble Free Motor Control Panels

12-Station Automatic Transfer Machine, built by Kearney & Trecker's Special Machinery Division. Performs a series of milling, drilling, and reaming operations on both left and right hand cylinder heads for V-8 engines. Special motor control panel was built by Allen-Bradley.





Bulletin 849
Pneumatic Timer

Bulletin 709
Automatic Solenoid Starter

Bulletin 802T
Oiltight Limit Switch

Bulletin 800T
Oiltight Push Button

Bulletin 702
Solenoid Contactor

Bulletin 700
Solenoid Relay

You get two definite advantages when you let Allen-Bradley furnish your special control panels, namely—trouble free, continuous reliability plus ready customer acceptance.

Allen-Bradley control panels are built from standard components whose reliability and maintenance free operation have been proven in many years of service. Their simple design is your guarantee of millions of trouble free operations. The familiar A-B trademark—recognized universally as the sign of QUALITY—is a decided sales asset on your equipment.

Write for your copy of the Allen-Bradley Handy Catalog—the quick and easy reference guide that will help you select individual control units, or components for special control panels.

7-56-R

A-B Quality

ALLEN-BRADLEY

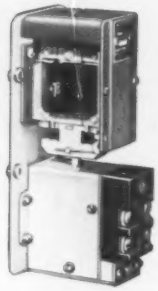
MOTOR CONTROL

QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

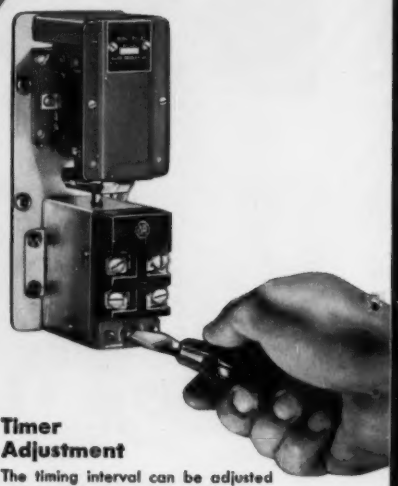
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

TIMING RELAYS!



Bulletin 849 "On-Delay" timer. By inverting solenoid, timer is converted to "Off-Delay" operation.

Installing instantaneously operated contact block with one N.O. and one N.C. contact



Timer Adjustment

The timing interval can be adjusted quickly and easily by turning the adjusting screw.

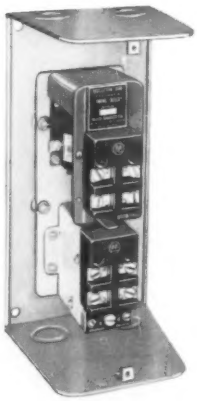
Tell Us About YOUR TIMER NEEDS . . . Allen-Bradley Has the RIGHT ANSWER!

Here is a line of pneumatic timers that can be adjusted for a consistent time delay of 1/6 second up to 3 minutes. Air, drawn into the timer through a needle valve, is freed from dirt and dust down to submicroscopic size by a high efficiency glass fiber paper filter. Thus the time settings are accurately maintained over long periods. These timers can be expected to operate reliably under conditions of severe atmospheric contamination.

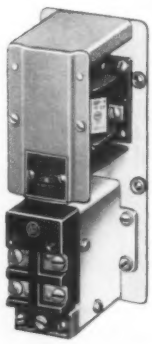
An outstanding feature of these timers is the wide variety of types available, and the modifications which can be made in the field, such as adding one or two instantaneously operated auxiliary contacts. Also, it is easy to change an "On-Delay" timer to the "Off-Delay" operation, or vice versa—by simply inverting the operating solenoid. The "On-Delay" timer provides the time delay *after* the magnetic operating COIL IS ENERGIZED; the "Off-Delay" timer provides the time delay *after* the operating COIL IS DE-ENERGIZED.

The Bulletin 849 timer has one normally open and one normally closed contact. As usual, the Allen-Bradley double break, silver alloy contacts are maintenance free. Auxiliary contacts can be mounted as shown below.

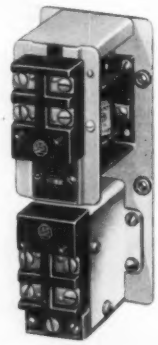
A few typical Bulletin 849 Pneumatic Timer combinations



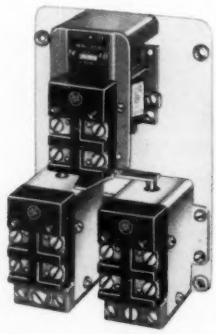
Bulletin 849 timer with one N.O. and one N.C. auxiliary contact.



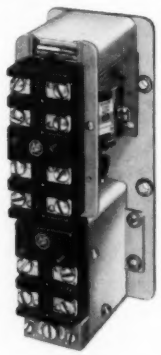
Bulletin 849 "Off-Delay" pneumatic timer with time delay *after* the coil is de-energized.



Bulletin 849 "Off-Delay" pneumatic timer with one N.O. and one N.C. auxiliary contact.



Bulletin 849 "On-Delay" pneumatic timer with two adjustable timing units.



Bulletin 849 pneumatic timer with two N.O. and two N.C. auxiliary contacts.

Allen Bradley Co.
1316 S. Second St.
Milwaukee 4, Wis.

ALLEN-BRADLEY
PNEUMATIC TIMERS

In Canada—
Allen-Bradley Canada Ltd.
Galt, Ont.

7-56-MR

high scorer

. . . and in high speed steels, it's always REX

Crucible's REX® high speed steel always scores highest on performance—as it has for more than a half century. That's because it is consistently sound and uniform in structure . . . with dependable response to heat treatment.

But don't take our word for it. Check REX for yourself—by any test you choose. You'll discover that recent improvements in manufacturing techniques have made it better than ever—why REX is today, as it's always been, *the standard by which all other high speed steels are compared!*

REX is immediately available at all Crucible warehouses, or on prompt mill delivery. For a list of helpful data on REX and other *special steels*, write for a free copy of the "Crucible Publication Catalog." *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor—Railway & Power Engineering Corp., Ltd.

For more information fill in page number on Inquiry Card, on page 231

CrysCoat* first, then paint...

to control under-coat corrosion

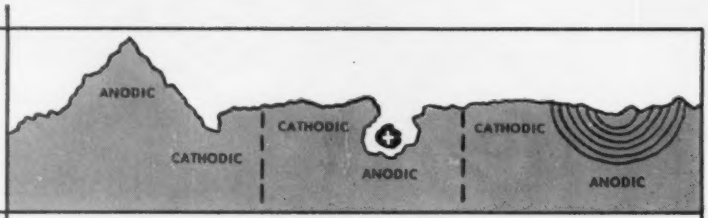


Fig. 1 — Magnified drawing illustrates formation of "cells" or microscopic peaks and valleys on steel surfaces. These cells cause electrochemical corrosion on untreated steel.

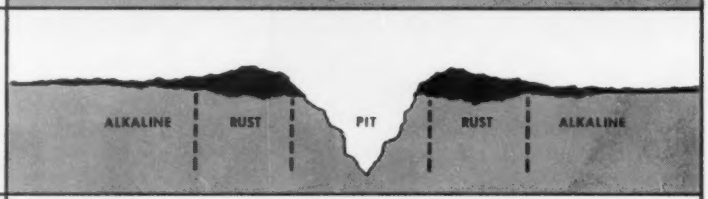


Fig. 2—Shows how electric flow on untreated steel carries iron away from anodic areas (causing pits) and piles iron oxides on cathodic areas. Rust then spreads and causes peeling of paint.

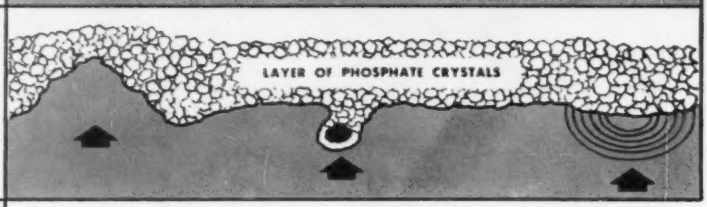


Fig. 3—Illustrates how electrically inert CrysCoat coating prevents electrochemical corrosion illustrated in Fig. 2. CrysCoat provides foundation for strong paint adhesion.

You do more with CrysCoat as a paint-base than just anchoring paint to product. The inert phosphate-coating formed by this Process actually becomes the new surface of the steel. It blocks electro-chemical causes of rusting.

CrysCoat eliminates points of electrical potential difference known to be created by surface stresses, trapped foreign matter, and microscopic surface irregularities. This overcomes tendency for electrical currents that tend to flow in the presence of moisture and corrode the surface. Result: CrysCoat keeps products looking better longer because it prevents the start of under-paint corrosion even at nicks and scratches.

With four Oakite CrysCoat Processes to choose from, there's one to meet the needs of your production set-up and product. The CrysCoat Man will give you the important details. Or send for Bulletin F8779 and F9475. Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

*A complete phosphating process by Oakite.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE®
MATERIALS · METHODS · SERVICE
SCIENCE

Export Division Cable Address: Oakite

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For more information fill in page number on Inquiry Card, on page 231

Caterpillar Tractor Co. Metallurgist T. H. Spencer inspects final drive pinion for D9 crawler tractor weighing 28 tons. Severe loading of this large pinion requires a steel with high case and core hardenability. Several years ago Caterpillar Tractor Co. found that simply by increasing the molybdenum content of AISI 8622 (to 0.30-0.40%), the desired properties were obtained at lower cost than was possible in any of the standard carburizing grades.

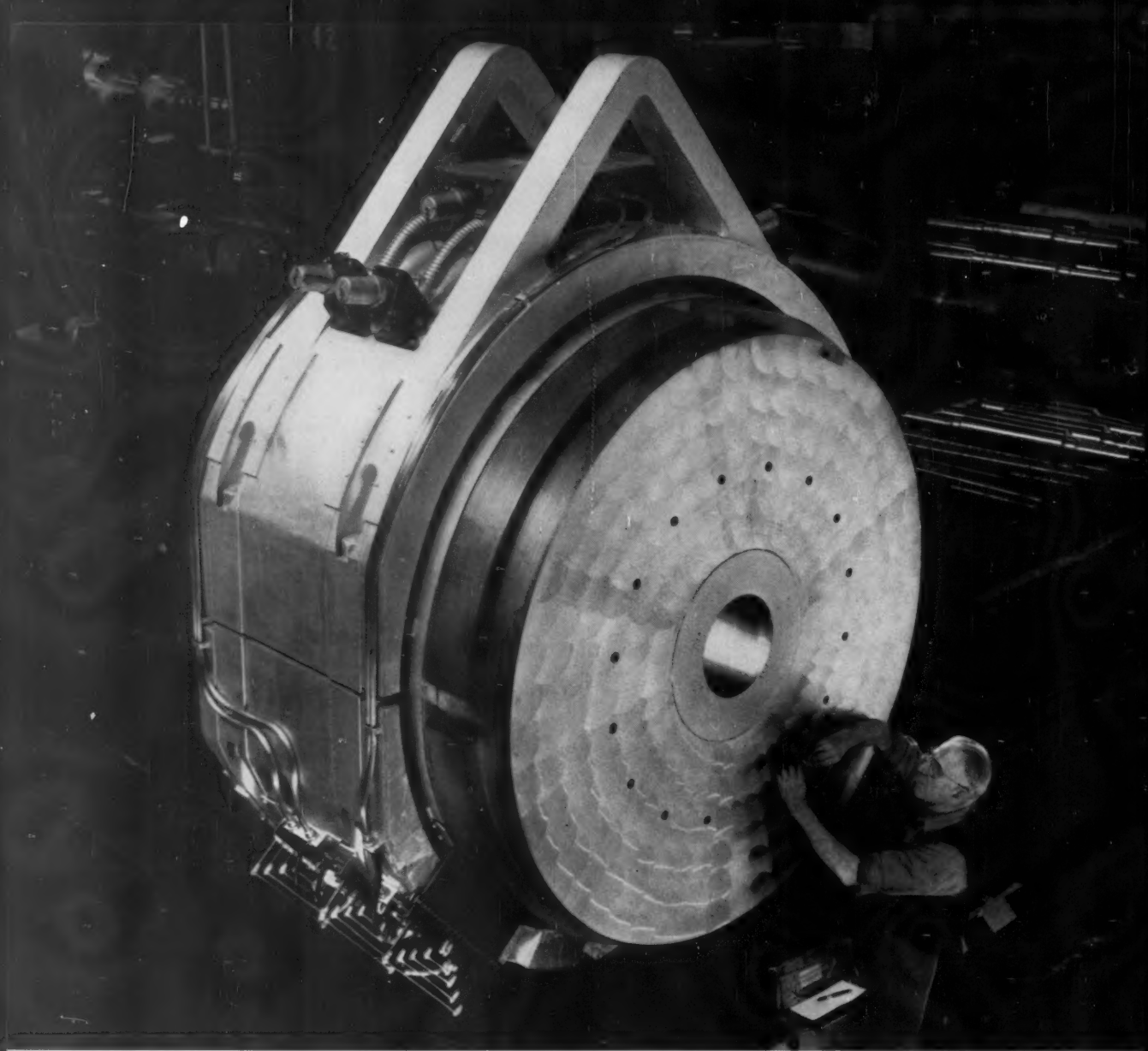
Caterpillar Tractor Co. improves case and core hardenability of carburizing steel by increasing molybdenum content

"Drive pinions in tractors must take very high torque loads," says T. H. Spencer, Metallurgist for Caterpillar Tractor Co. "AISI 8622 steel, which we had been using, couldn't give us the hard case and strong, tough core we needed in these heavy sections. Other standard carburizing steels with the requisite properties would have cost substantially more. We found, however, that we could achieve the desired surface and core properties by simply modifying AISI 8622 with a higher percentage of molybdenum. We have been using this composition for several years, and results have been excellent."

Caterpillar Tractor Co.'s experience shows how increasing molybdenum in a carburizing steel helped to solve a specific problem. Perhaps your product, too, can benefit by higher molybdenum content.

A technical article, "New Carburizing Steels for Critical Gearing", describes some recent investigations of higher-moly carburizing steels. For a reprint, write Climax Molybdenum Company, Dept. 13, 500 Fifth Avenue, New York 36, N. Y.

CLIMAX MOLYBDENUM



Puzzle: Find the Sleeve

Unless you had a hand in the design or manufacture of this alloy steel billet-container, you might have trouble finding the sleeve we're talking about. Yet part of it is in plain sight.

First of all, we'd better explain a little about the assembly. That outer shell with the lifter loops is heating equipment. Just inside this shell is the billet-container proper, made entirely in the Bethlehem shops. The whole device will be part of one of the 8,000-ton extrusion presses designed and built by Loewy-Hydropress, Division of Baldwin-Lima-Hamilton, for the U.S.A.F. Heavy Press Program.

Now, getting back to the mystery of the sleeve. The container is made up basically of three layers of forgings — a liner (plainly visible), the sleeve, and an outer layer. Because of the perfect shrink fit and the accurate machining, you can't see where the sleeve meets the outer layer. But the sleeve is there, all right, and it runs the full length of the assembly.

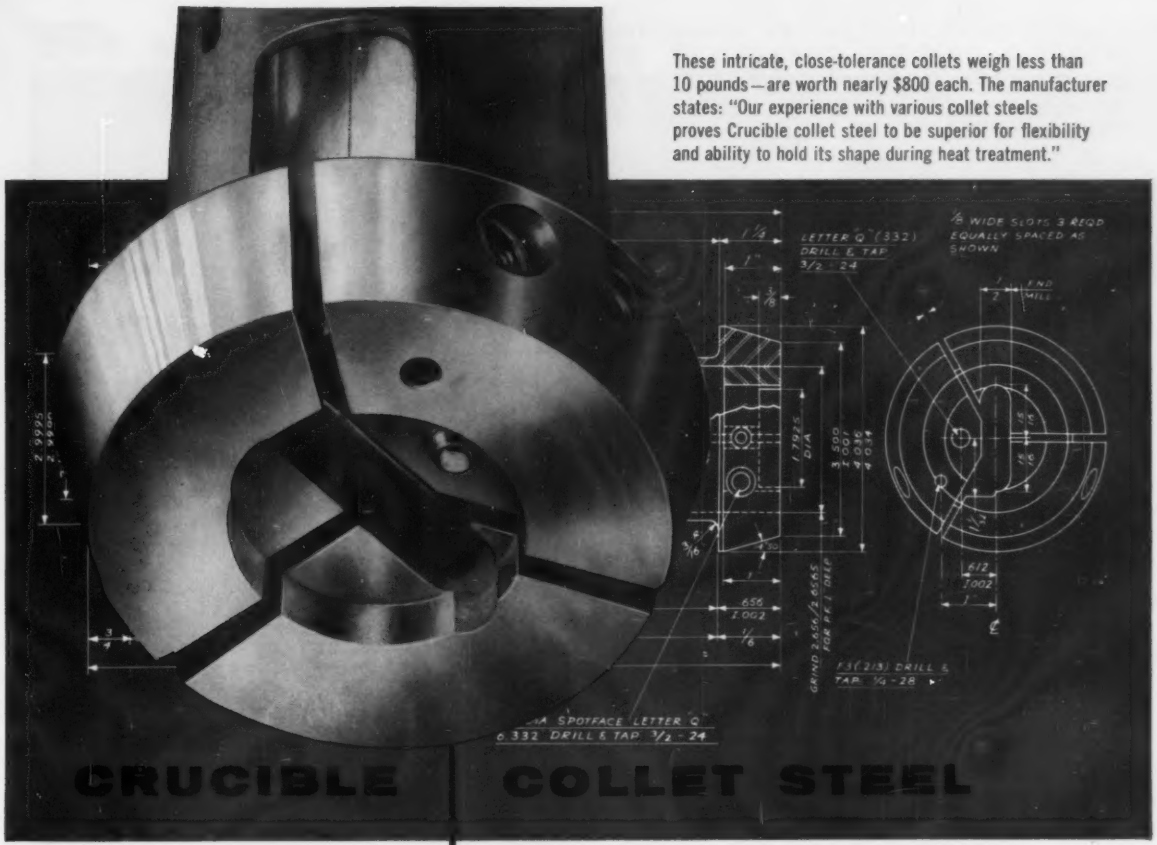
Bethlehem has handled many forging and machining jobs that were bigger than this one; the whole assembly weighs only 41 tons. But we've had very few that required more careful workmanship. The container shown here is one of several that Bethlehem was commissioned to do — and all will of course be built to the same high standards.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

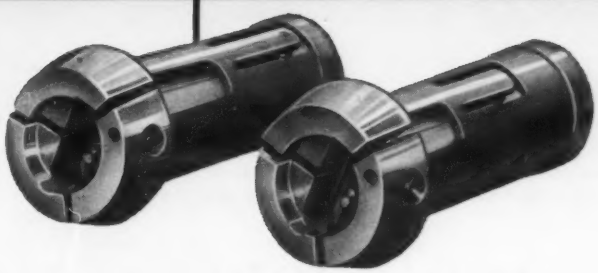
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL


LETTER Q (.332) DRILL & TAP 3/2 - 24
1/8 WIDE SLOTS 3 REQD EQUALLY SPACED AS SHOWN
END MILL
GRIND .266/.265 FOR PF.1 DIEF
F.S (213) DRILL & TAP 1/4 - 28
A SPOTFACE LETTER Q .332 DRILL & TAP 3/2 - 24
CRUCIBLE COLLET STEEL

These intricate, close-tolerance collets weigh less than 10 pounds—are worth nearly $800 each. The manufacturer states: "Our experience with various collet steels proves Crucible collet steel to be superior for flexibility and ability to hold its shape during heat treatment."



for minimum distortion after heat treatment

These collets are used in machining the anchoring end of jet engine turbine blades, while locating the part from reference points on the airfoil section of the blade. It's a job that demands a steel which will not distort during heat treatment. The collet head is heated to Rockwell 58-60 C—the body tempered to 35-38 C.

The steel used is a special Crucible non-warping alloy collet grade. The collet manufacturer, Balas Collet Mfg. Co., Cleveland, Ohio, reports: *The extreme accuracy built into these collets while they are still in the soft state shows less than .0005" distortion on any dimension after heat treatment.*

Crucible collet steel was developed specifically for spring collets—or *any* parts with rigid requirements of excellent machinability and high attainable hardness. Other properties—in almost limitless combination—can be had in other Crucible alloy grades. To see what information is available on these alloy steels—or *any* Crucible special steel—get your copy of the *Crucible Publication Catalog.* Write *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

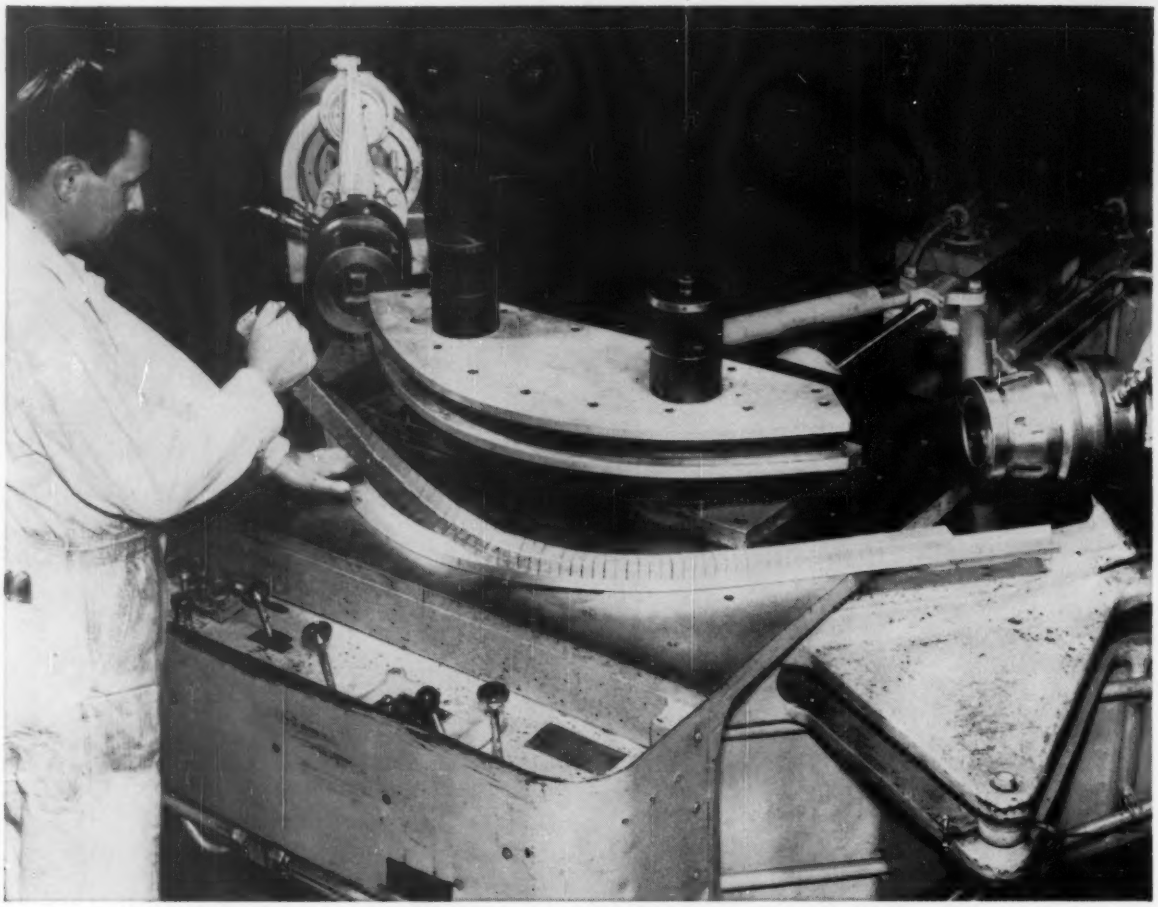
CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

For more information fill in page number on Inquiry Card, on page 231

Made with MAGNESIUM for better stretch-forming.

DOW



TO THE RESCUE! Magnesium snake and tooling plate stretch-forming die has eliminated a lot of headaches for Hufford Machine Works, Redondo Beach, California. Galling, which causes scratching and excessive wear in stretch-forming aluminum extrusions, is no longer a problem since the company switched to magnesium dies. Something else, too—tool costs were cut 20%!

NO GALLING PROBLEM HERE!

Magnesium tooling plate solves this problem in stretch-forming aluminum

Latest development in stretch-forming — magnesium tooling plate. The number one reason is that magnesium's fine-grain, porosity-free structure and better slippage reduce galling to practically *nothing*.

Hufford Machine Works recently substituted dies made of magnesium tooling plate for the steel and aluminum ones they had been previously using. The result: the magnesium dies ran 500 pieces without showing wear and the aluminum extrusions showed no scratch marks!

There are other advantages to magnesium tooling plate. Light weight—one-fourth that of steel, one-third less than aluminum—makes magnesium dies much easier to handle and use. Excellent rigidity, strength and dimensional stability are also magnesium characteristics . . . as well as outstanding machinability and weldability.

Ready availability and lower prices complete the magnesium tooling plate picture. It's a picture you should look into to solve your own tooling problems! For more information about magnesium tooling plate contact your nearest supplier of Dow magnesium, or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 369CC.

AVAILABLE FROM STOCK AT: Copper and Brass Sales, Inc., Detroit, Mich. • Fullerton Steel and Wire Company, Chicago, Ill. • Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Company, Los Angeles, Calif. • Vinson Steel and Aluminum Co., Dallas, Texas.

you can depend on DOW MAGNESIUM DOW

For your protection when you want GRAPH-MO® tool steel remember...

THERE IS ONLY ONE GRAPH-MO TOOL STEEL and it is made *only* by the Timken Company. Graph-Mo is a registered trade-mark owned by The Timken Roller Bearing Company covering our own graphitic type oil-hardening alloy tool steel.

GRAPH-MO IS THE ORIGINAL OIL-HARDENING GRAPHITIC TOOL STEEL. Graph-Mo is a metallurgical development of The Timken Roller Bearing Company, who developed and promoted the graphitic type tool steels.

GRAPH-MO TOOL STEEL IS AVAILABLE ONLY through the authorized tool steel distributors of The Timken Roller Bearing Company.

MAKERS of quality dies, gages, punches and machine parts rely upon the Graph-Mo® trade-mark to insure the quality and economy needed for their parts. We're proud of that confidence. We prize Graph-Mo's reputation. The trade-mark Graph-Mo helps us protect this reputation. That trade-mark protects *you,* too. Here's why:

The trade-mark Graph-Mo identifies the most stable, machinable and wearable of all tool steels. By specifying Graph-Mo, the original graphitic tool steel, you can always be sure of these advantages and the high quality you've come to expect from Timken fine alloy steels.

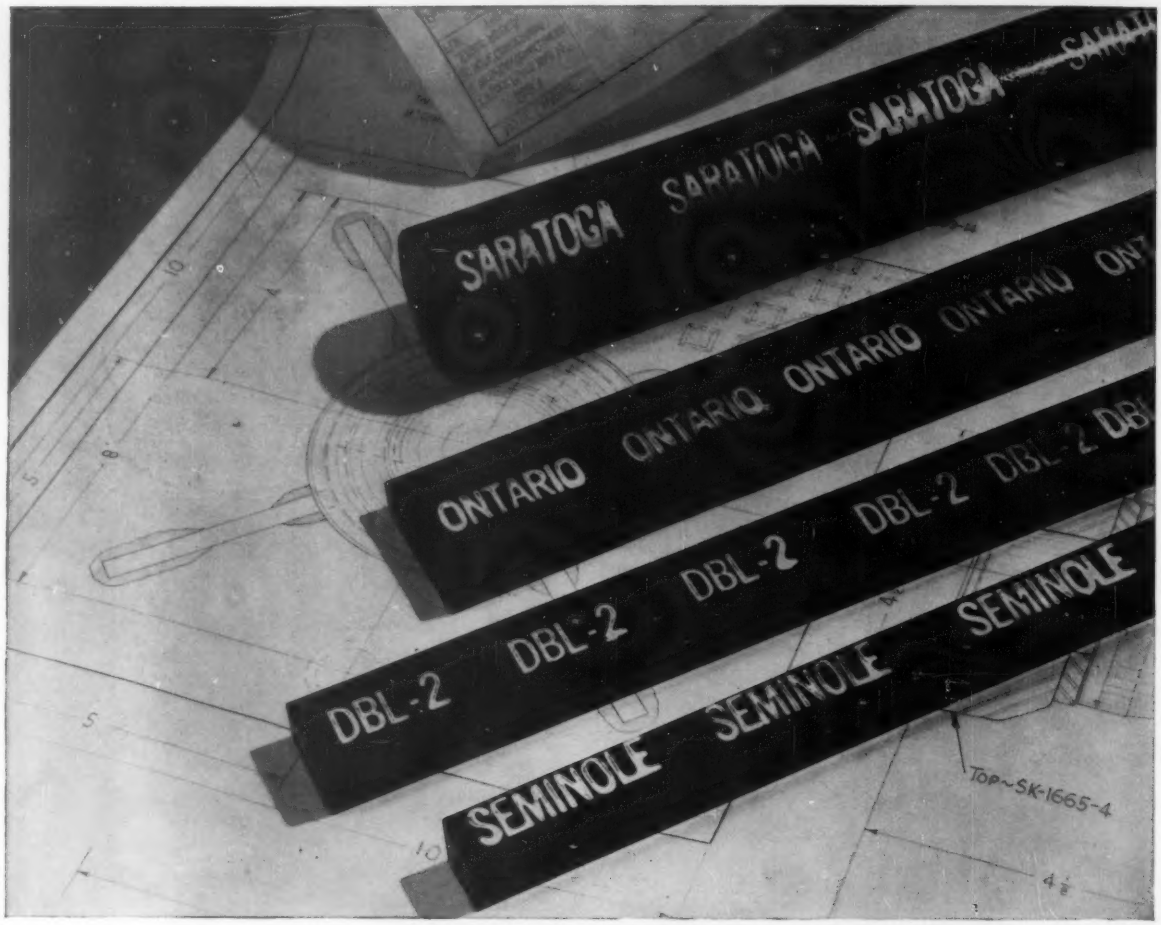
To be sure you get Graph-Mo, always specify it by name. And remember it is available only through authorized distributors of the Timken Company. For more information about it or our other specially developed graphitic tool steels, send for the new 10th edition of "Timken Graphitic Steel Data Book". Write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO". Tapered Roller Bearings, Alloy Steel and Seamless Tubing, Removable Rock Bits.

TIMKEN *Fine Alloy* STEEL

TRADE-MARK REG. U.S. PAT. OFF.

See us at the NATIONAL METALS EXPOSITION, October 8-12, Public Auditorium, Cleveland, Ohio, Booth 1051

For more information fill in page number on Inquiry Card, on page 231



AL TOOL STEELS are *clearly* marked
. . . you can't mix up grades in your stock

For Production Men Only

"TOOL STEEL HANDBOOK"

We say "production men only" because this is a *work* book, not a picture book. It's a case-bound volume of 196 pages, packed full of technical data on the analyses, uses, handling and shop treatment of all grades of A-L Tool and Die Steels. Sent free, but ask for it on your company letterhead, please.

Address Dept. M-81

"What's *that* piece?" . . . "Are you *sure?*" . . . In anybody's toolroom or stock racks, the best inventory or material identification system is apt to go haywire once in a while—and sometimes with grievous results.

But not when you're using tool steel grades produced by Allegheny Ludlum! Each length of AL Tool Steel is clearly marked with its grade name every few inches the entire length of the bar—*stenciled* in such a manner that the marking stays bright and clear, and can't be blurred or erased in handling.

Even a small crop end on a machine bench is readily identifiable—you can't go wrong. And that's only a small part of the benefit you can realize by using AL Tool Steels—available from stocks coast to coast. Let our Metallurgical Service go to bat on some of your tougher tool steel problems. ***Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.***

For nearest representative, consult Yellow Section of your telephone book.

For complete **MODERN** Tooling, call

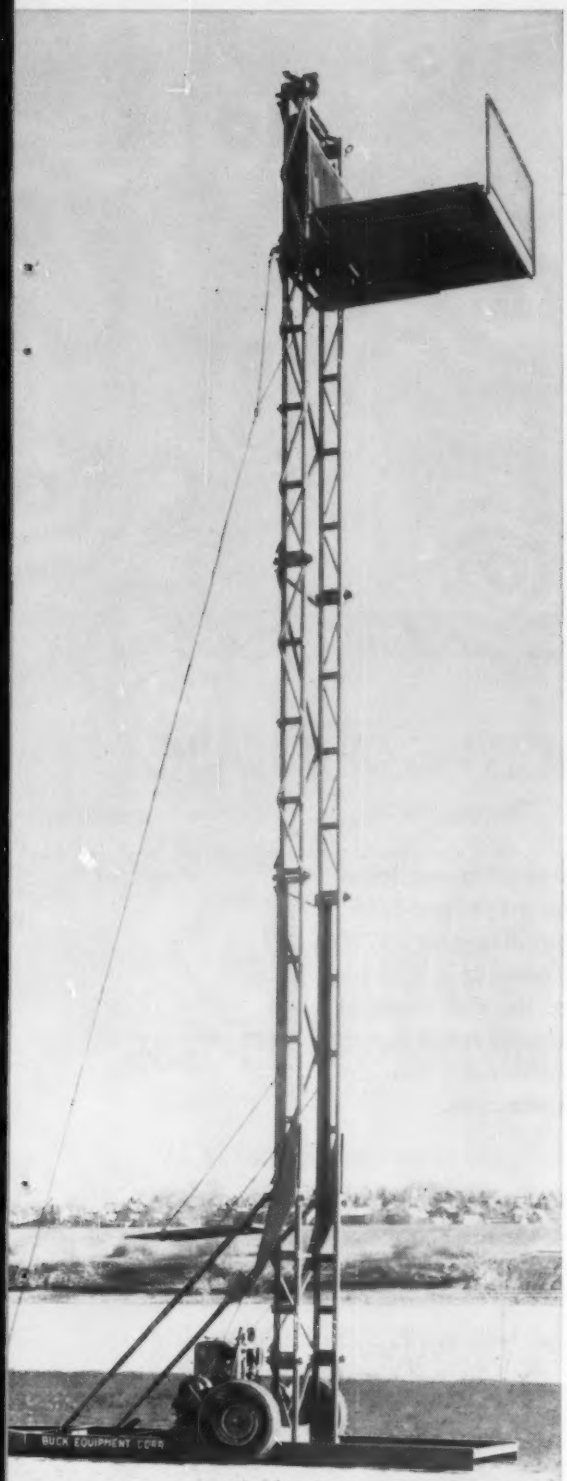
Allegheny Ludlum

WSW 6221A

AL® FINE TOOL STEELS SINCE 1854

For more information fill in page number on Inquiry Card, on page 231

How Shelby Seamless Tubing makes a "Buck" go farther



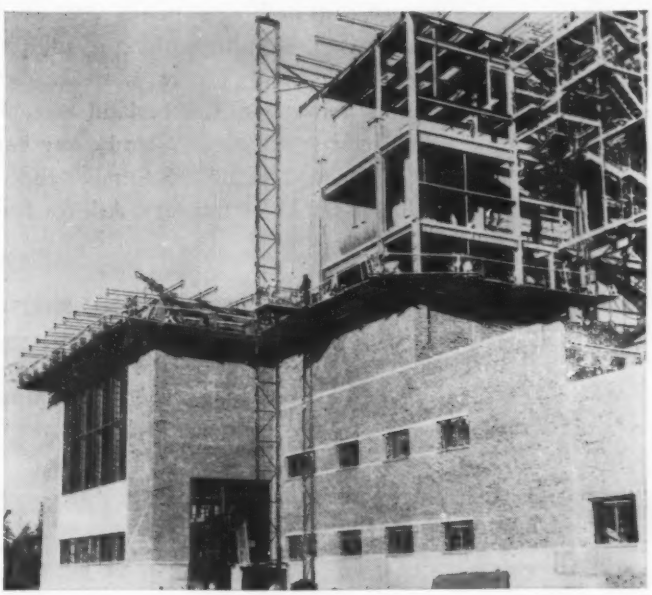
The platforms of these Buck Equipment Corporation Hoisting Machines* *do* go farther—farther *up,* thanks to Shelby Seamless. Although standard tower heights range from 25 to 40 feet, some of these unique heavy-duty rigs boast towers up to 150 feet in height!

The slender tower of the Buck Portable Hoisting Machine is constructed of 2⅜" OD x .120" wall, cold drawn sections of Shelby Seamless Mechanical Tubing, which afford both the structural support for the equipment and the track on which the platform moves. Self-erecting, the tower unfolds like a jackknife—raises or lowers in 2 minutes, 11 seconds. Operating power is supplied by a 21 H. P. air-cooled engine.

Here is an application where the use of seamless tubing is virtually mandatory. What other material could supply the combination of high strength, light weight, and flexibility needed to make a completely portable hoist that would unlimber in minutes, then send a 2000-pound load of building bricks soaring up its vertical track at the rate of 140 feet per minute?

Shelby Seamless Tubing possesses the strength, uniformity and dimensional accuracy that make it ideal for structural applications such as this. Produced to exacting standards by the world's largest manufacturer of tubular steel products, Shelby Seamless is available in a wide range of diameters, wall thicknesses, various shapes and steel analyses. You are invited to consult our engineers at any time. They will make a study of your product requirements and will help you to apply Shelby Seamless to your specifications.

**Manufacturer's name on request.*



NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

SHELBY SEAMLESS MECHANICAL TUBING

WALLS WITHOUT WELDS

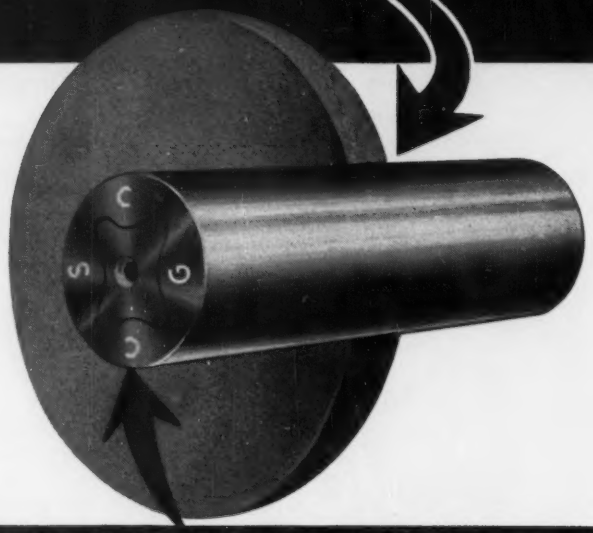
UNITED STATES STEEL

An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight, smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 **INCORPORATED 1892**

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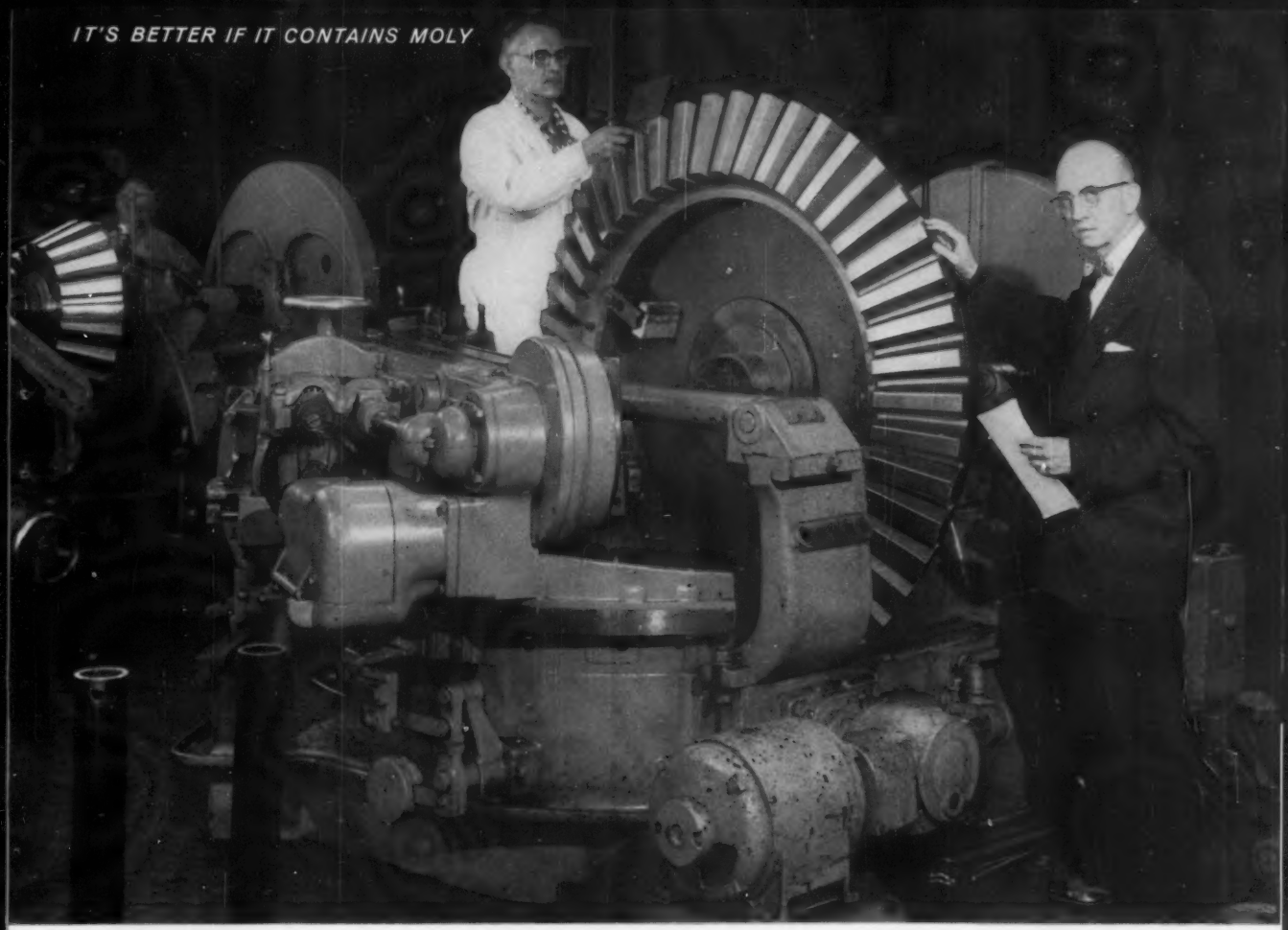
IT'S BETTER IF IT CONTAINS MOLY



E. B. Smiley, Metallurgist for Illinois Gear & Machine Co., looks over setup of large, heavy duty bevel gear made from molybdenum alloy steel casting. This gear has been rough turned, rough cut and heat treated to 269 to 302 Brinell before finish cutting.

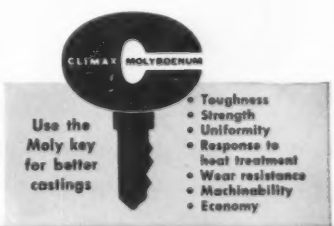
For Strength, Hardness and Machinability gear maker recommends Molybdenum Alloy Steels

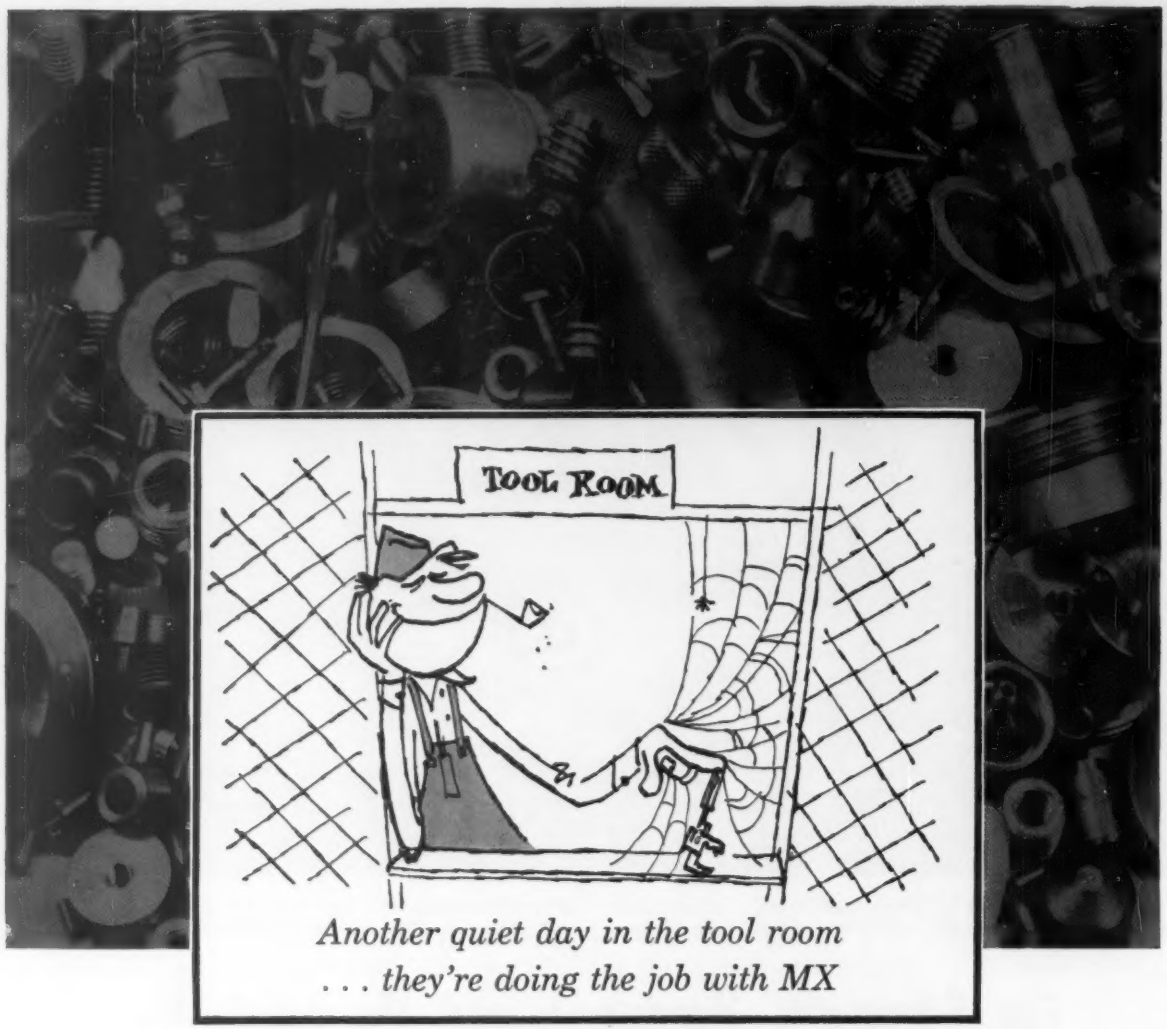
"All of our gears are made to customer specifications, and in many cases these include the use of molybdenum steels," says Mr. Smiley, metallurgist for Illinois Gear & Machine Co. "When our customers specify heat-treated gears of plain carbon steel," Mr. Smiley continues, "we often recommend that they change to 4140 alloy containing molybdenum to achieve high strength and hardenability with good machinability."

Moly steels offer gear users many advantages over carbon steel. Their greater strength and toughness permit the use of smaller weight-saving gears to transmit a given amount of power. Reduced weight and size of gear housings and other components add to the economy of moly steels. And their higher endurance is an important safety factor.

The properties of moly steels are discussed in a new booklet "Moly Steels for Cast Gears". Full technical assistance is also yours for the asking. Write Climax Molybdenum Co., Dept. 13, New York 36, N. Y.

CLIMAX MOLYBDENUM





Another quiet day in the tool room
. . . they're doing the job with MX

USS FREE-MACHINING MX STEEL works *with* your tools, not against them. That's because USS MX has been specifically designed to ensure maximum cutting speeds compatible with economical tool life — and it does exactly that.

As a result, in the hundreds of shops that have put MX to work, tools have lasted up to 200% longer. Cutting speeds have increased as much as 50%. Output has been boosted an average of 40%.

USS MX has so consistently outperformed ordinary screw stock that we can tell you with complete confidence that *MX will cut the cost of any part* you now machine from regular Bessemer grades. What's more, the parts you make will be *better* parts—more accurate, of better finish. Rejects will be fewer.

And here's another reason why MX is your best buy today. Despite the fact that it *costs no more than ordinary screw stock*, USS MX has been successfully machined at speeds approaching 350 SFM — speeds far higher than the average (under 250 SFM) used in most shops today.

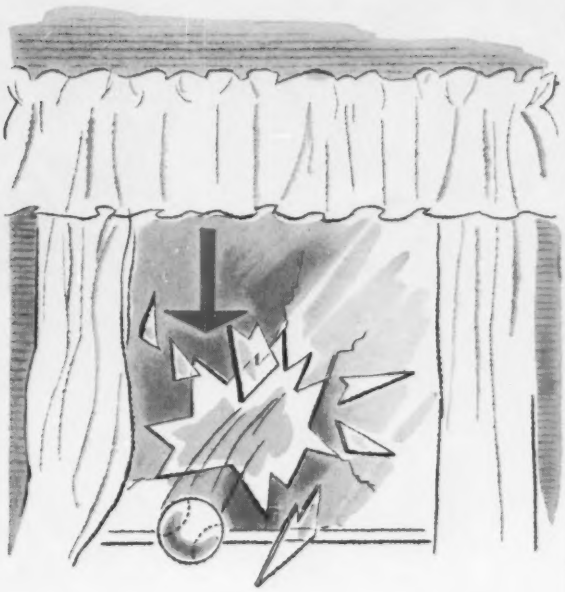
Available in both Bessemer and Open Hearth grades, USS Free-Machining MX Steel is produced in all the popular screw stock sizes. It is sold in cold finished form by your regular supplier, either as "MX" or under his identifying trade name. In hot-rolled form, MX is available through our nearest sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Longer tool life . . . bigger output . . . lower costs
***—when you do the job with free-machining* MX**

USS

UNITED STATES STEEL



a hole here means work...

a hole here saves work

Crucible Hollow Tool Steel Bars take much of the work out of making ring-shaped steel parts, or tools with a center hole. The hole's already there. You save expensive drilling, boring, cutting-off and rough-facing operations . . . you reduce machine time and scrap losses.

You can now get Crucible Hollow Tool Steel Bars in any of the famous Crucible tool steel grades, in virtually any I.D. and O.D. combination. And you can get *immediate delivery* from stock of the five most useful grades — KETOS oil-hardening . . . SANDERSON water-hardening . . . AIRDI 150 high-carbon, high-chromium . . . AIRKOOL air-hardening . . . NU DIE V hot-work tool steels.

Your Crucible representative can quickly show you how Crucible Hollow Tool Steel Bars will save you work and money. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

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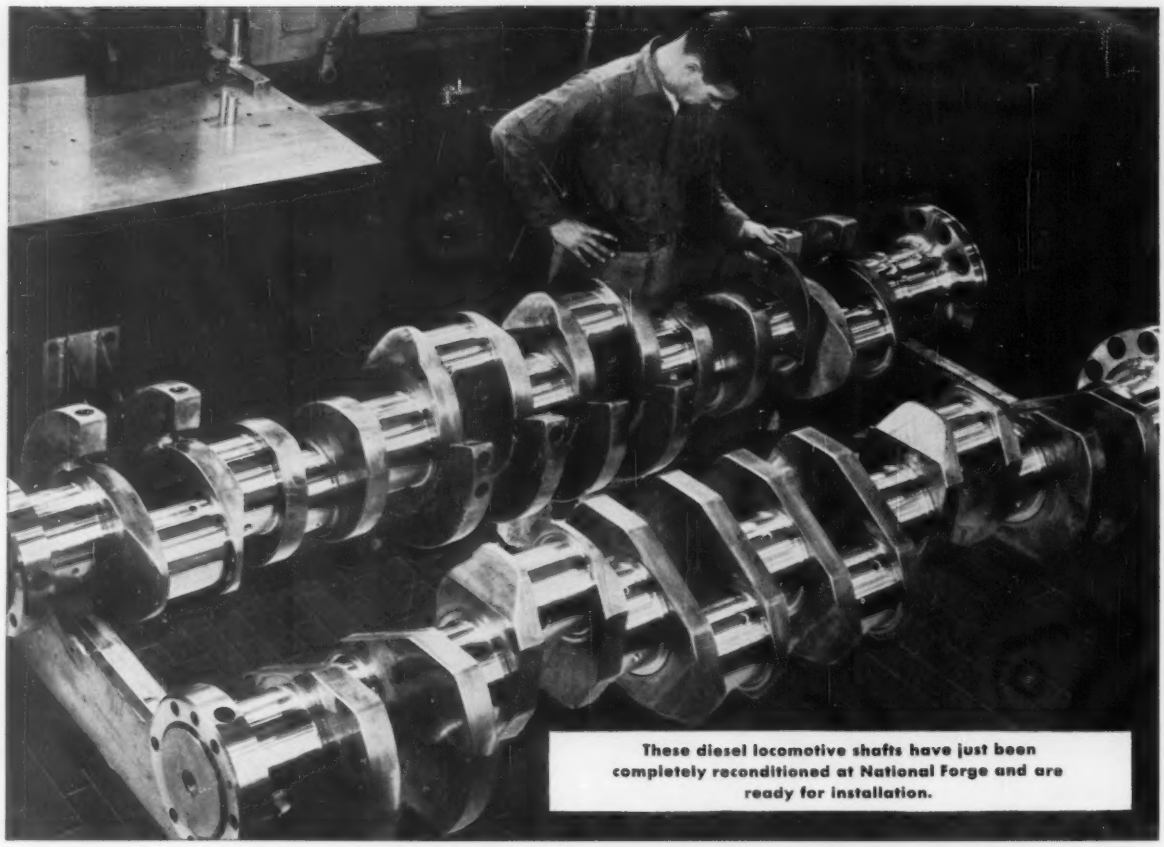

These diesel locomotive shafts have just been completely reconditioned at National Forge and are ready for installation.

RECONDITIONING DIESEL LOCOMOTIVE SHAFTS

● National Forge has been well recognized as a supplier of quality crankshafts for original equipment for over forty years. Through these years we have kept abreast of the steadily increasing demands for greater quality and workmanship.

Now this experience and "know how" have been applied to the problem of reconditioning worn crankshafts. National Forge has established a complete and separate department for this rebuilding which includes a newly developed chromium plating process and facilities for straightening, grinding and polishing.

National Forge offers you this complete rebuilding service for your worn crankshafts. We will be pleased to have your inquiries and will be glad to have our field representatives discuss this service with you.

NATIONAL FORGE AND ORDNANCE COMPANY

PRODUCES BETTER STEEL FORGINGS AND MACHINE WORK

IRVINE, WARREN COUNTY, PENNSYLVANIA

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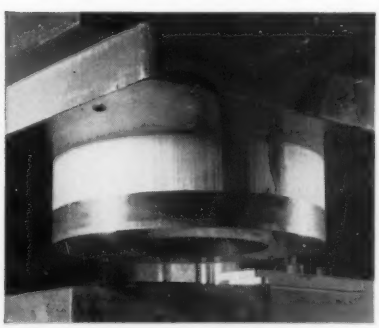
Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Good Results with BTR Hollow-Bar in Manufacture of Fan Housing

Based upon all-around performance — less time spent in machining, good resistance to wear, and ease of heat-treatment — dies of BTR (Bethlehem Tool Room) Hollow-Bar rang the bell recently at Electrolux Corp., Old Greenwich, Conn.; the steel was supplied by Lindquist Steels, Inc., Bridgeport, Conn.

The dies, hardened to approximately Rockwell C 60, and operating in a 100-ton press, formed fan housings from 25-gage zinc-coated sheet steel at the rate of more than 1600 pieces per hour. Redressing was required once every two months or so, and then no more than 0.010 in. was removed.



BTR Hollow-Bar is made from our oil-hardening tool steel by a process called high-speed trepanning. By this method, we take hammer-forged round bars, core the inside diameter, then give them a rough-turning on the outside.

With BTR Hollow-Bar there's no need to run up shop costs waiting for delivery of forged rings or discs. Instead, this fine tool steel comes to you ready to go, with no need for drilling, rough-boring, rough-facing or rough-turning.

Your Bethlehem tool-steel distributor will be glad to explain how BTR Hollow-Bar can be of real service to you. Or a phone call or letter to the nearest Bethlehem sales office will bring you detailed information promptly.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Remove all the "Bark" from Liquid-Quenched Tools

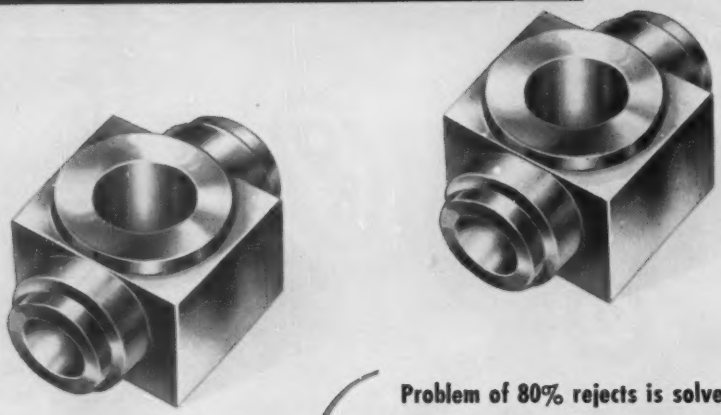
Most users of tool steel realize that it is necessary to remove the "bark" (scaled and decarburized outer surface) from tool-steel bars in order to obtain full, uniform hardness in heat-treatment. If this area is not removed, low hardness will result because of the low carbon content of the decarburized metal. It is not always recognized that this procedure is necessary on tools which are to be liquid quenched, even though portions of the tool do not constitute working surfaces.

If tools are to be liquid quenched, all the bark must be removed to avoid excessively high quenching stresses which could cause cracking of tools during hardening. Low carbon areas on the surface transform during hardening at a different time than the higher carbon interior. This sets up additional stress which, added to the high thermal stresses from quenching, could cause cracking. Air-hardened tools can tolerate bark on non-working areas because of the low hardening stresses in air hardening. But with liquid-quenched tools there are no exceptions — remove all the bark.

"Teamwork," Bethlehem's new motion picture on tool steel, received a second film award, a silver reel symbolic of excellence, at the recent American Film Assembly competition in Chicago.

The 16-mm, 30-minute color film explains the manufacture, quality control and heat-treatment of Bethlehem tool steels. It is available for showings to machinists, heat-treaters, die makers and tool manufacturers. To see the film, write to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

2 Stainless Parts . . . *look alike*



but with 1 of them

Problem of 80% rejects is solved

This is a precision part for a military bombsight. Some of the tolerances are ±.0001". Dependability is a "must". Every factor has to be "on the nose". Yet when the subcontractor used several ordinary Type 416 Stainless steels, rejects ran as high as 80%. But then he made one change . . . to Carpenter No. 5 (Type 416) . . . and eliminated the problem.

Tool life increases

Also, tool life was short, machine downtime excessive, and production was lagging. Then one change was made—to Carpenter Stainless No. 5—and machining time was shortened, tool life raised to a trouble-free level.

Production jumps

With Carpenter No. 5 production of this part is up to schedule because the reject problem has disappeared, machining time stepped up and tool life increased. Here is just one more example of how *Carpenter quality* makes a real difference in stainless fabrication. The next time you order stainless, be sure it's Carpenter. Watch it speed production—ease headaches from first operation to the last.

Make the one change that counts . . .

change to *Carpenter* STEEL — **Free-Machining Stainless**

take the problems out of production

THE CARPENTER STEEL COMPANY, 105 W. Bern St., Reading, Pa.
Export Department: The Carpenter Steel Co., Port Washington, N.Y.—"CARSTEELCO"
For fast delivery, call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor

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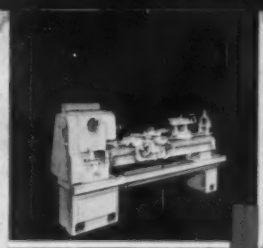
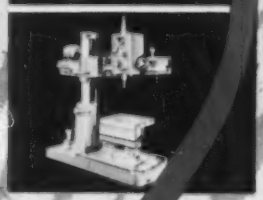
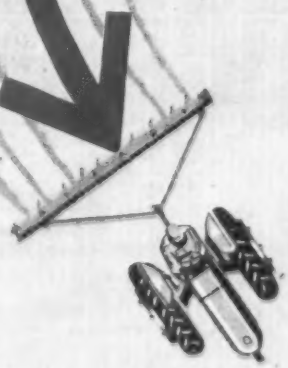






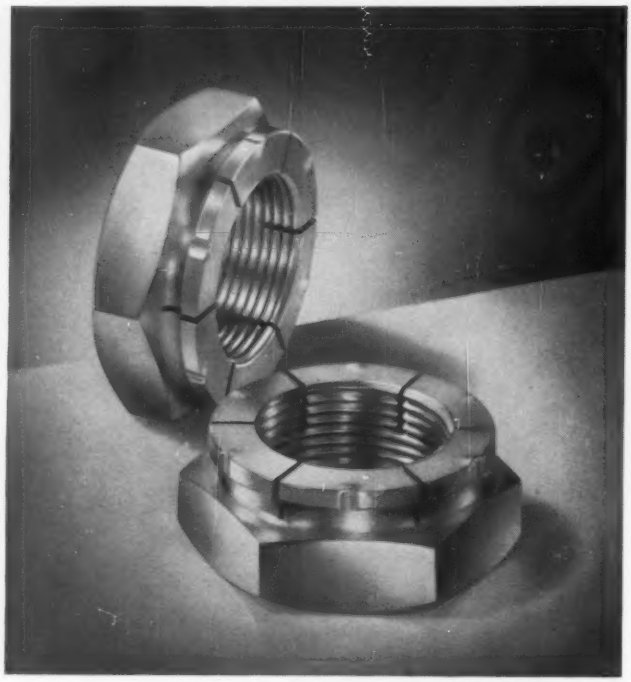
AGRICULTURAL equipment makers know the hazards of outmoded equipment and are actively replacing many of their 19,000 drilling machines and 13,000 lathes.* Over *half* these machines are more than 10 years old and this is the average for *all* the nation's machine tools. Yet modernization is quick and inexpensive with "Standard Machine Tools" developed against fresh, new concepts of appearance, function and accuracy. To this end, Cincinnati Lathes and Drills are built to do much of your jobbing, tooling, maintenance and light production work at tremendous savings. Write for complete catalog information. Cincinnati Lathe and Tool Co., 3247 Disney, Cincinnati 9, Ohio.

*Figures from American Machinist's Seventh Inventory.

center on... **cincinnati lathes and drills**

Machines shown are Cincinnati's new 3'7½" Hardclad Radial Drill and 15" Tray-Top Lathe.

Flexloc thin nuts save space, weight and production time



Self-locking nuts are 30% lower and lighter; speed up assembly with hand or power tools

Self-locking FLEXLOC thin nuts are 30% lower than regular height locknuts of the same nominal diameter. They fit into spaces where regular height locknuts will not go. You can design lighter, more compact units with them.

Where you must reduce weight in a completed assembly, you can save by using shorter bolts with these lighter nuts. And you save production time. The length of engagement of mating threads is shorter: fewer revolutions of hand wrenches or power nut runners are needed to seat them.

FLEXLOC nuts are of 1-piece, all-metal construction. You can use a FLEXLOC fully seated as a locknut or at any point along a bolt as a stop nut. Once the threads in the resilient locking section are fully engaged, the FLEXLOC grips the mating threads with uniform locking torque wherever wrenching stops. Since there are no nonmetallic inserts to come out or deteriorate, the locking life of a FLEXLOC is virtually unlimited.

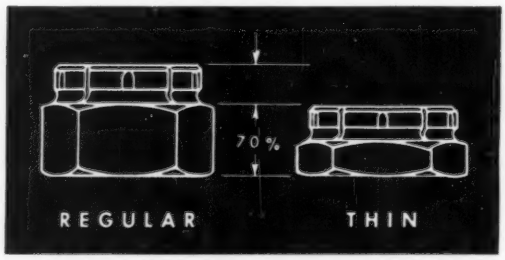
Your authorized industrial distributor stocks FLEXLOC nuts in a variety of sizes, materials and finishes. Consult him for details. Or write us for information about your special locknut problem. Flexloc Locknut Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

SPECIFICATIONS
FLEXLOC THIN NUTS

NATIONAL COARSE THREAD—U.S.S

SIZE	A INCHES	H INCHES	WIDTH ACROSS CORNERS	WEIGHT PER 1000 NUTS
6-32	.312	.125	.361	1.8
8-32	.344	.172	.397	2.8
10-24	.375	.172	.433	3.3
¼-20	.438	.203	.505	5.4
5/16-18	.563	.250	.649	11.6
⅜-16	.625	.265	.722	14.9
7/16-14	.750	.312	.866	24.9
½-13	.813	.312	.938	28.4
9/16-12	.875	.359	1.010	36.1
⅝-11	1.000	.391	1.155	54.1
¾-10	1.125	.406	1.299	69.2
⅞-9	1.312	.469	1.516	107.5
1-8	1.500	.563	1.732	171.6
NATIONAL FINE THREAD—S.A.E.				
6-40	.312	.125	.361	1.8
8-36	.344	.172	.397	2.8
10-32	.375	.172	.433	3.3
¼-28	.438	.203	.505	5.4
5/16-24	.500	.250	.577	8.7
⅜-24	.563	.266	.649	11.5
7/16-20	.625	.312	.722	14.9
½-20	.750	.312	.866	21.7
9/16-18	.875	.359	1.010	36.2
⅝-18	.938	.391	1.082	42.4
¾-16	1.063	.406	1.227	54.5
⅞-14	1.250	.469	1.443	84.6
1-14	1.438	.563	1.660	136.3
1 1/16-12*	1.625	.625	1.876	193.5
1 ¼-12*	1.813	.750	2.093	296.0
1 3/16-12*	2.000	.812	2.309	389.0
1 ½-12*	2.187	.875	2.526	498.0

*Steel only (plain or cadmium plated) in stock sizes.

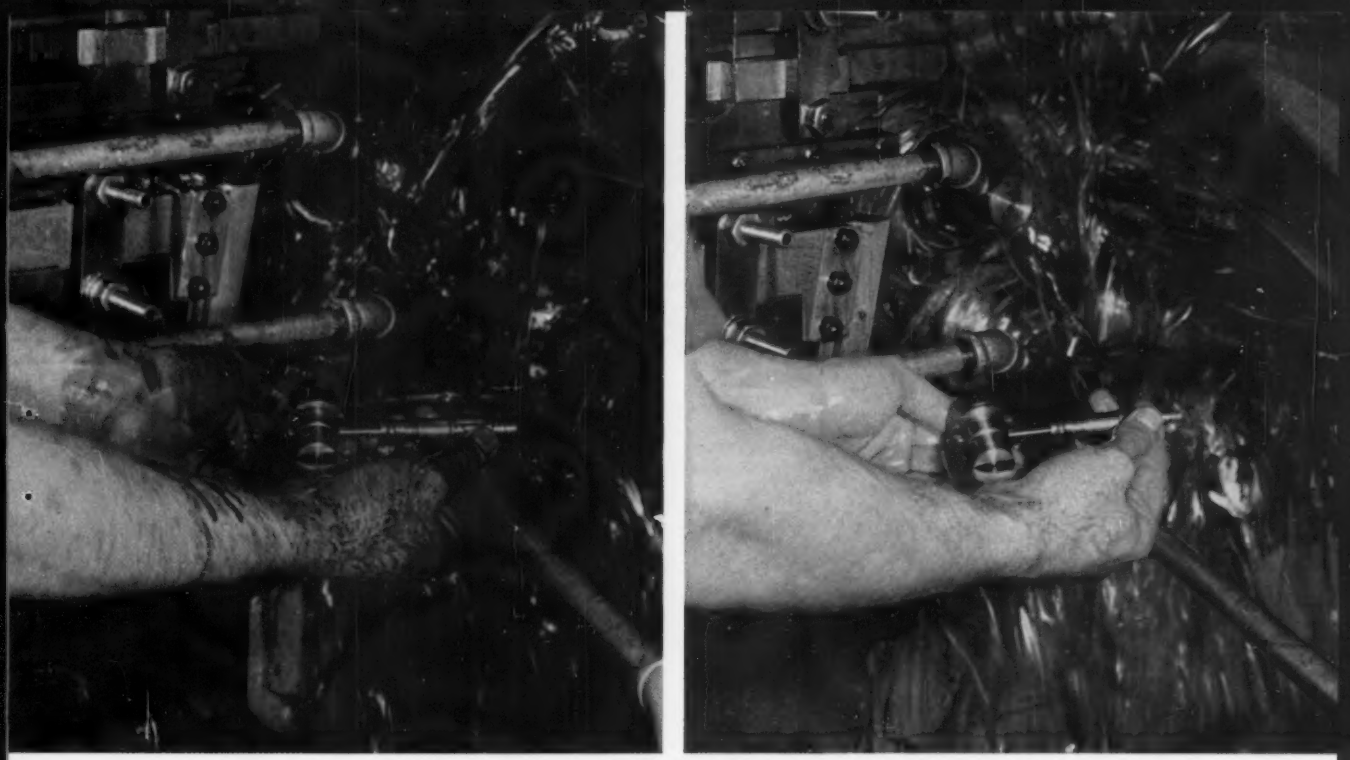


FLEXLOC thin nuts are 30% lower than regular height locknuts. There is a corresponding saving in weight. In sizes through 5/16 in., thin FLEXLOCS meet tensile strength requirements for regular height locknuts. FLEXLOC nuts can be made in the thin type because every thread, even those in the locking section, carries its full share of the load. There are no nonmetallic inserts to waste head space or weaken the structure of the nut.

Standard FLEXLOC self-locking thin nuts are available in plain or cadmium plated alloy steel, for use in temperatures to 550°F; in plain or silver plated corrosion resisting steel, for temperatures to 750°F; and in brass and aluminum, for temperatures to 250°F.

STANDARD PRESSED STEEL CO.
FLEXLOC LOCKNUT DIVISION SPS
JENKINTOWN PENNSYLVANIA

For more information fill in page number on Inquiry Card, on page 231



Black cutting oil (left) makes close control difficult. Operators dislike dirty operating conditions it creates. Close control is easier and workers are happier with transparent Sunicut cutting oil (right).

WHY USE A BLACK CUTTING OIL WHEN YOU DON'T NEED IT?

Sunicut oils give you better visibility without sacrificing machining efficiency.

When trying to maintain close control over machines producing precision parts, operators can be handicapped by "black-oil blindness". It is hard to see the tools, the workpiece, and the finishes. Checking close tolerances is difficult when the graduations on micrometers and gauges are obscured.

Worse still, as the operator sees it, are the dirty working conditions caused by dark oils. His clothes get saturated with hard-to-remove stains, and his hands are black from one end of the shift to the other.

Transparent Sunicut oils help keep your operators happy and will make close control easier ...and transparent Sunicut oils will do the job with no sacrifice in machining speed or finishes.

To get the full story on Sunicut oils, see your local Sun representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-41.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

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IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

For any machining or grinding operation...

THERE'S A SUN OIL THAT'LL GIVE YOU HIGH EFFICIENCY AND LOW OVER-ALL COST

No two machine shops have exactly the same problems when it comes to selecting cutting oils...even when they're running the same job. And, until somebody comes up with the truly universal cutting oil, you can't afford to disregard the importance of oil selection. Here's how Sun can help you.

First, Sun makes a complete line of emulsifying and straight cutting and grinding oils. Second, your Sun representative, backed up by field engineers, has the necessary practical experience to recommend the oil that will give you both high machining efficiency and low over-all costs.

For the full story about Sun's cutting oils, see your Sun representative...or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-42.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

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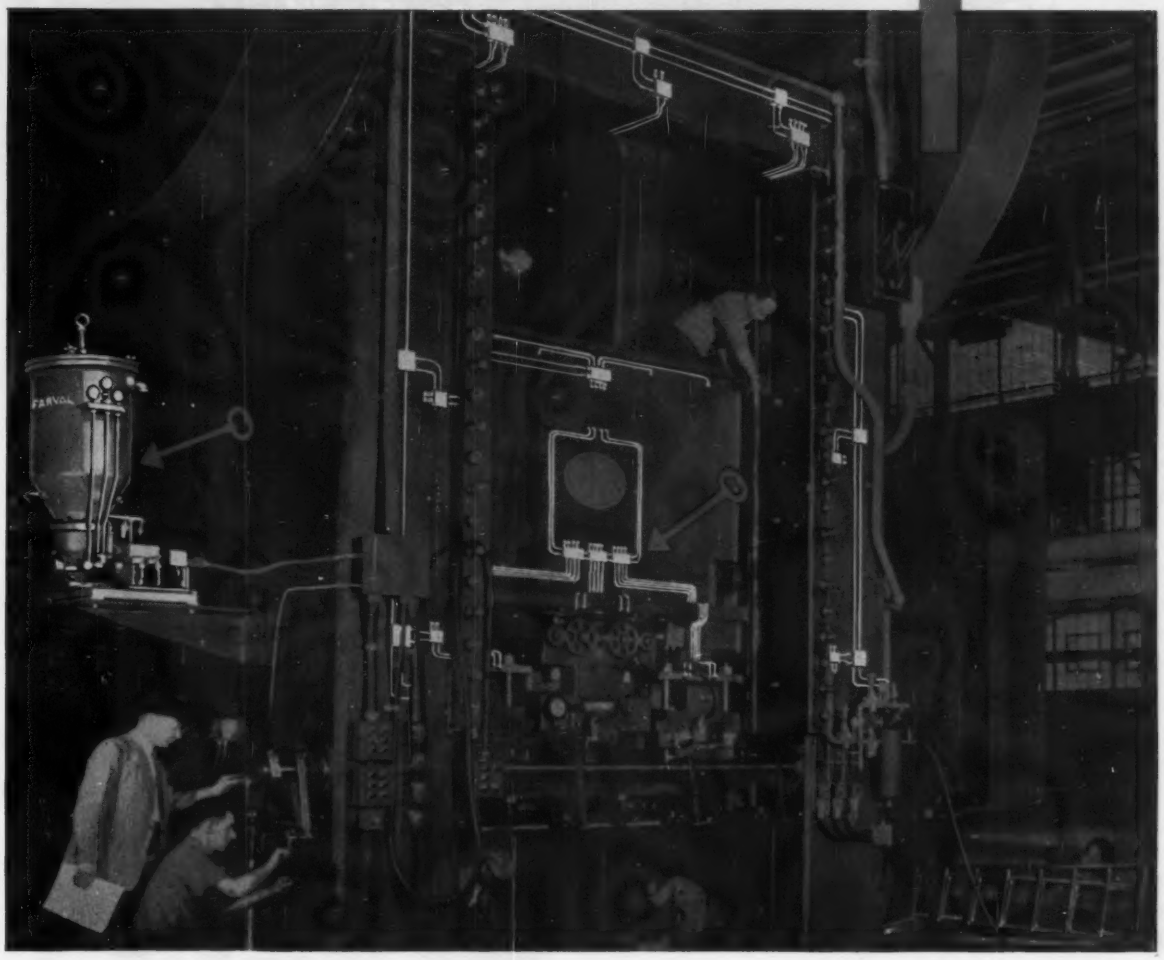
IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

Farval guards bearings as press pierces projectiles from hot billets

FARVAL—
Studies in Centralized Lubrication
No. 187



● One of the most recent developments in transfer presses, this giant Bliss pierces 105 mm projectiles from hot billets. Heat becomes so intense during operation that two internally water cooled punches are needed at each station—and they are used alternately.

With heat like this, adequate lubrication of bearings is vital. That's why a Farval Centralized System of Lubrication was installed by the press manufacturer. Farval delivers a measured amount of clean lubricant at regular intervals to every bearing. There's nothing hit-and-miss about Farval, as an indicator at each bearing shows positive proof that its individual lubricant measuring valve has functioned.

Let Farval solve your lubrication problems, too. For complete information, write for Bulletin 26-R. The Farval Corporation, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Co., Industrial Worm Gearing. In Canada: Peacock Brothers Limited.

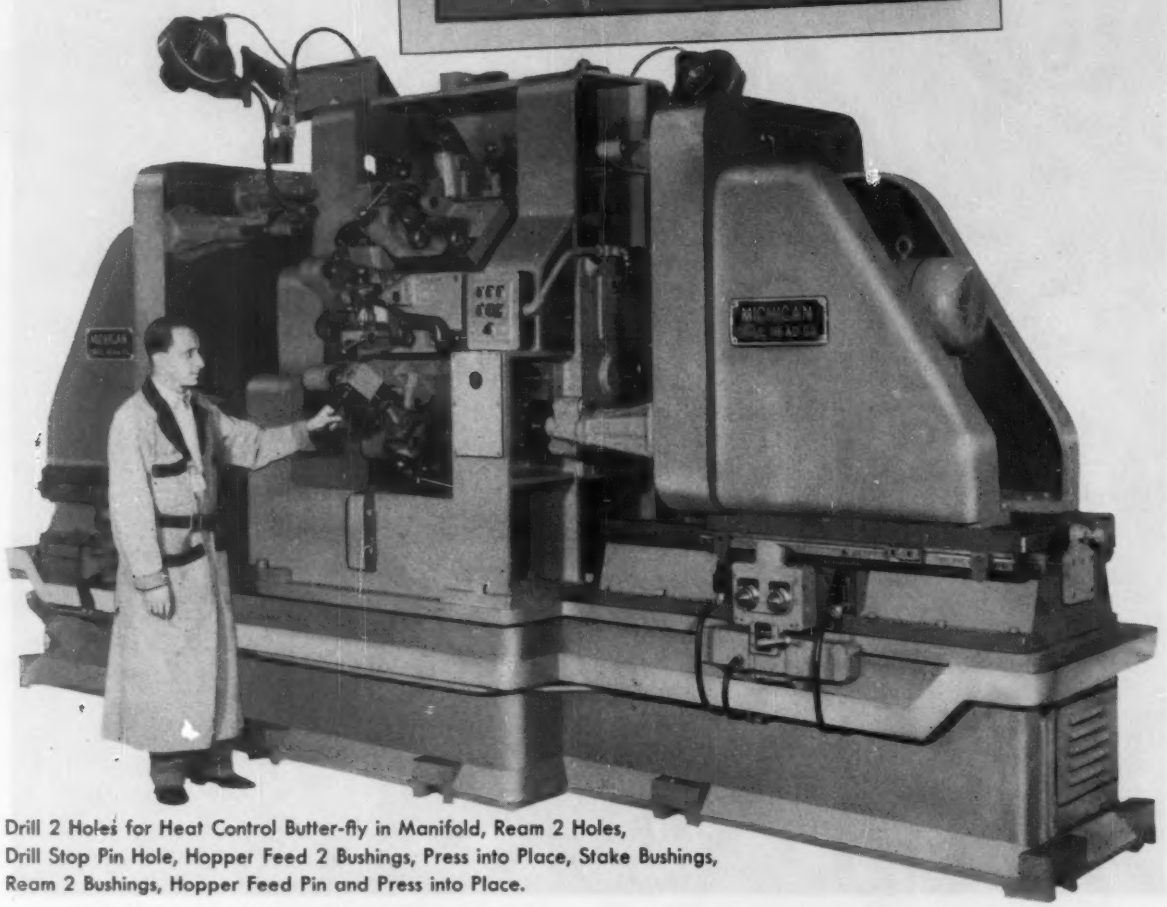
KEYS TO ADEQUATE LUBRICATION—

Wherever you see a Farval central pumping station, dual lubricant lines and valve manifolds, you know a machine is being properly lubricated.

Photo shows workmen assembling Bliss Projectile Press, Farval systems very much in evidence.

For more information fill in page number on Inquiry Card, on page 231

DOUBLE END DRILLING AND ASSEMBLY MACHINE WITH AUTOMATIC INDEX



Drill 2 Holes for Heat Control Butter-fly in Manifold, Ream 2 Holes, Drill Stop Pin Hole, Hopper Feed 2 Bushings, Press into Place, Stake Bushings, Ream 2 Bushings, Hopper Feed Pin and Press into Place.

THIS MACHINE PRODUCES

120 Manifolds per Hour with Bushings and Pin in Place. The Units are Hydraulic with automatically lubricated, Hardened and Ground Ways with Vickers Controls on the Hydraulic Pump and Control Panel.

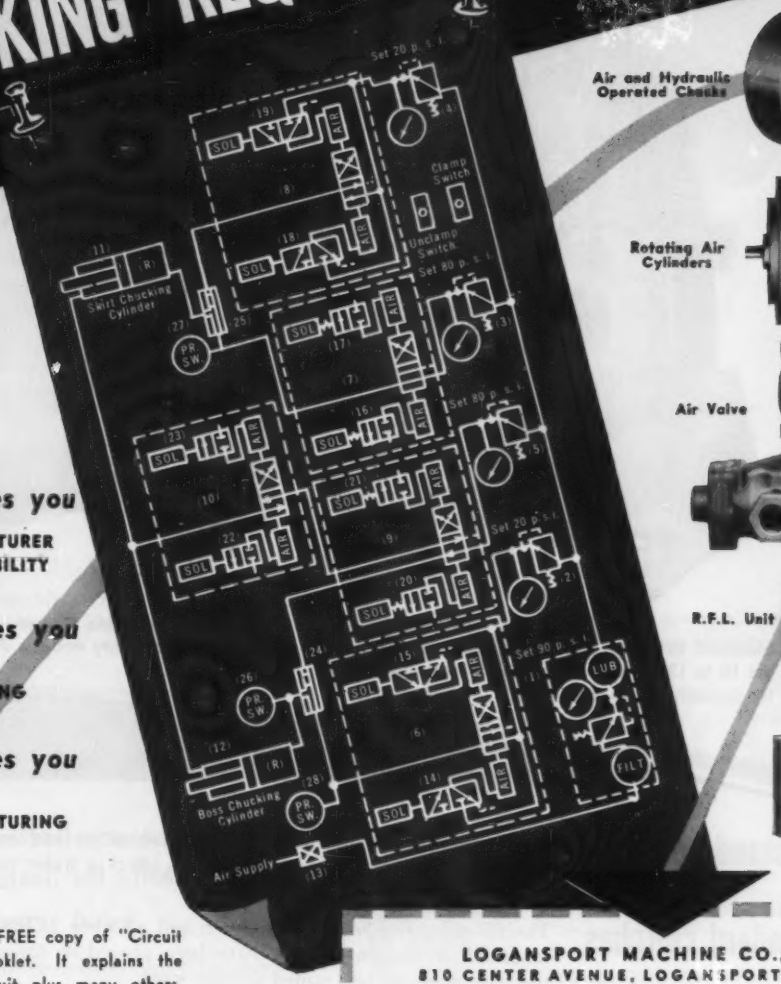
For Faster, More Economical Production

We also invite your inquiries as to our line of tapping units, and index tables, both manual and automatic.

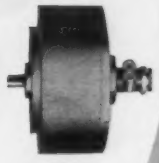
Michigan DRILL HEAD CO. Detroit 34, Michigan

engineers and manufacturers of production machines and drilling equipment

For your complete power CHUCKING REQUIREMENTS—specify Logan

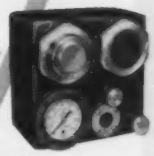


Air and Hydraulic Operated Chucks

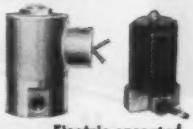


Rotating Air Cylinders

Air Valve



R.F.L. Unit



Electric-operated Air Valves

Logan gives you 1 MANUFACTURER RESPONSIBILITY

Logan gives you 1 ORDER PURCHASING

Logan gives you 1 SOURCE MANUFACTURING

Write for FREE copy of "Circuit Rider" booklet. It explains the above circuit plus many others.

SAVES TIME — Logan AIR AND HYDRAULIC EQUIPMENT — EFFORT-MOTION

MEMBER
Natl. Mach. Tool Builders' Assn., Natl. Fluid Power Assn.

YOUR DEPENDABLE SINGLE SOURCE FOR ALL AIR AND HYDRAULIC EQUIPMENT

Logan

PROPERLY DESIGNED — PROPERLY EQUIPPED

LOGANSPORT MACHINE CO., INC.
810 CENTER AVENUE, LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

- ☐ 100-1 AIR CYLINDERS
- ☐ 100-2 MILL-TYPE AIR CYLS.
- ☐ 100-3 AIR-DRAULIC CYLS.
- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
- ☐ 100-5-1 ULTRAMATION CYLINDERS
- ☐ 51 PRESSES
- ☐ FACTS OF LIFE
- ☐ 62 SURE-FLOW PUMPS
- ☐ 200-1 HYD. POWER UNITS
- ☐ 200-2 ROTOCAST HYD. CYLINDERS
- ☐ 200-3 750 SERIES HYD. CYLINDERS
- ☐ 200-4 and 200-7 HYD. VALVES
- ☐ 200-6 SUPERMATIC CYLS.
- ☐ 70-1 CHUCKS
- ☐ ABC BOOKLET
- ☐ CIRCUIT RIDER

TO:

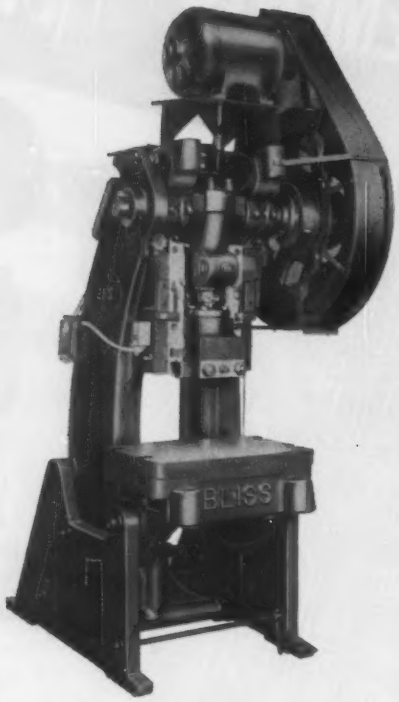
NAME_____ TITLE_____

COMPANY _____

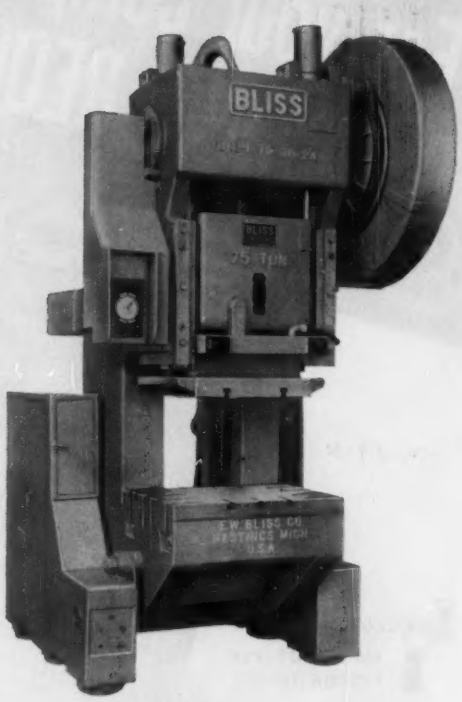
ADDRESS _____

For more information fill in page number on Inquiry Card, on page 231

Bliss inclinables offer you a wider



Standard Inclinable Presses—as furnished in the 10 to 125 ton range. No. 21-S press, 45 ton capacity, shown here.



Enclosed Inclinable Presses—75 to 200 tons. A 75-ton capacity model is shown here.

More standard types Bliss builds 23 standard inclinables—open-back inclinables, JIC inclinables, hydraulic inclinables, double-crank inclinables . . . offers a wider range of capacities and bed areas than any other make.

More standard clutches The Bliss Positive rolling key clutch and a choice of Bliss crankshaft or driveshaft mounted air friction clutches have been proved on thousands of presses. Bliss has the type of clutch best suited to your work.

More standard feeds Bliss designs and manufactures its *own* line of roll and dial feeds. This single responsibility for both presses and feeds is the press user's assurance that feeds are easily installed and easily adjusted.

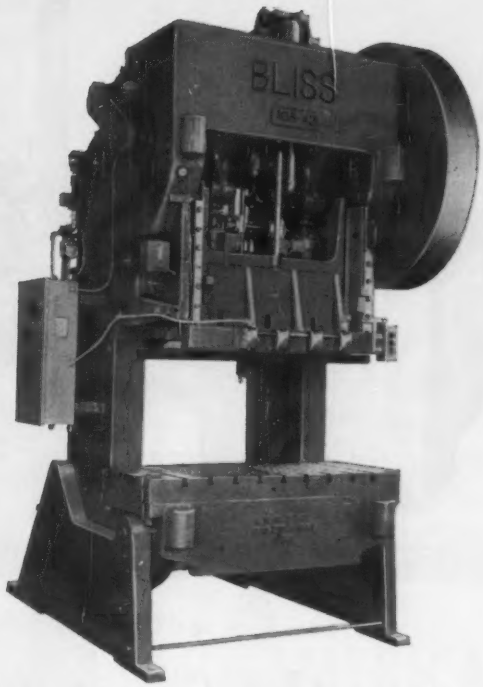
More standard cushions Five different types of cushions, in a range of sizes that meet every need, make any Bliss inclinable a double-action press. Cushions are especially designed for the press, and the presses designed to receive them—either assembled to press before shipment or easily installed years later.

. . . And a million dollar parts and service program to protect your investment!

Because Bliss *mass-produces* its inclinables, maintaining a stock-pile of spare parts is a simple matter. The million-dollar inventory of spare parts of Bliss' inclinable plant is by far the largest in the industry and includes clutch plates and parts, shafts, gears, pinions and the like. Moreover, Bliss maintains a separate, specially-trained organization whose sole purpose is to service your spare parts needs as quickly as possible.

choice of standard types and sizes

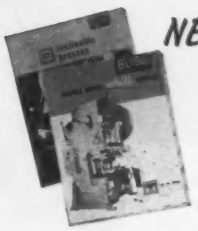
Standard Enclosed Inclinable as furnished in 150 and 200 ton sizes. No. 29, 150-ton capacity, is shown above.



Double-crank Inclinable Presses—from 18 to 175 tons. No. 108, of 100 tons capacity, is shown here.

A few of the reasons why BLISS inclinables outsell all other makes ... *and always have*

- Cast Meehanite frame—stronger, tougher. Fine grain structure dampens noise and vibration.
- Clutches—whose design has been proved by the thousands now in use.
- Gibs are close fitting, extra long, and insure accurate slide alignment at all points in the stroke. Simple to adjust so that original accuracy can always be maintained.
- Choice of hand, semi-automatic or automatic lubrication.



NEW catalogs now available

32 pages—describes frames, feeds, clutches, cushions and complete line of open back and enclosed single-crank inclinable presses. Gives dimensions and specifications. Catalog No. 2-D.

12 pages—describes these versatile extra-width double-crank presses. Gives dimensions and specifications for entire line. Catalog No. 3.

BLISS
SINCE 1857

BLISS is more than a name ... it's a guarantee!

E. W. BLISS COMPANY, Canton, Ohio

Presses, Rolling Mills, Special Machinery

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; San Jose, California; Midland and Pittsburgh, Pa. *Branch offices in* Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Pittsburgh, Philadelphia, Rochester, Salem, San Jose, Toledo, Washington, D. C.; and Toronto, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. *Other representatives throughout the world.*

the finest high production lathes

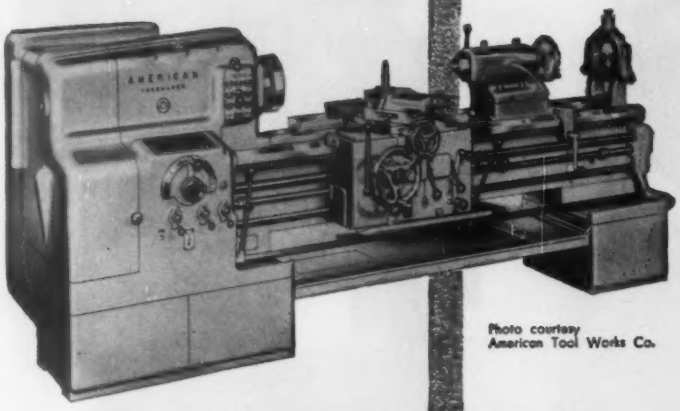
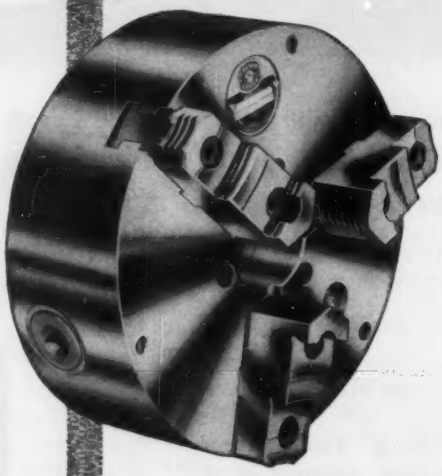


Photo courtesy American Tool Works Co.

Here is the new 16" DeLuxe Model "AMERICAN" Pacemaker Lathe. This new design places particular emphasis upon the factors of power, stamina, dependability, precision, accuracy and ease of operation required for both production and tool room service. For complete data write for Bulletin No. 116, The American Tool Works Co., Cincinnati 2, Ohio.

deserve the finest high production chucks

This is Horton's 3-Jaw Scroll Universal Chuck which for more than 100 years has been the companion to the world's finest lathes. Its lasting accuracy and precision contribute to the high production of any tool room or plant. For the complete story on this and Horton's complete line of high production chucks, see the Horton people in your area now.



HORTON Since 1851 CHUCK

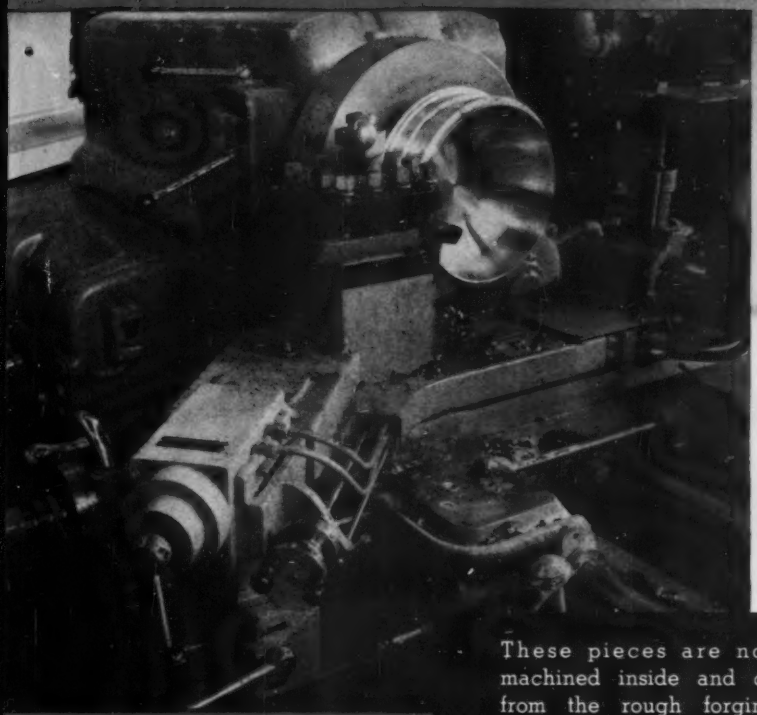
HORTON CHUCK DIVISION
GREENFIELD TAP AND DIE CORPORATION
WINDSOR LOCKS, CONN.

For more information fill in page number on Inquiry Card, on page 231

Rheem solves a "toughie"

and increases production

three hundred per cent

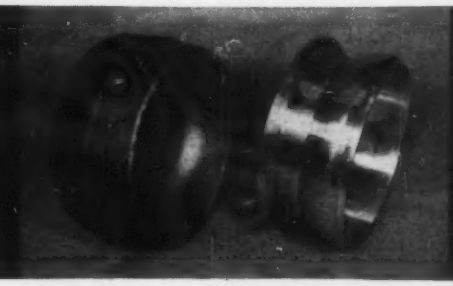


Machining the various contours of these guided missile components with the accuracy and finish required was a problem that Rheem Mfg. Co., Aircraft Division at Downey, California, had to lick.

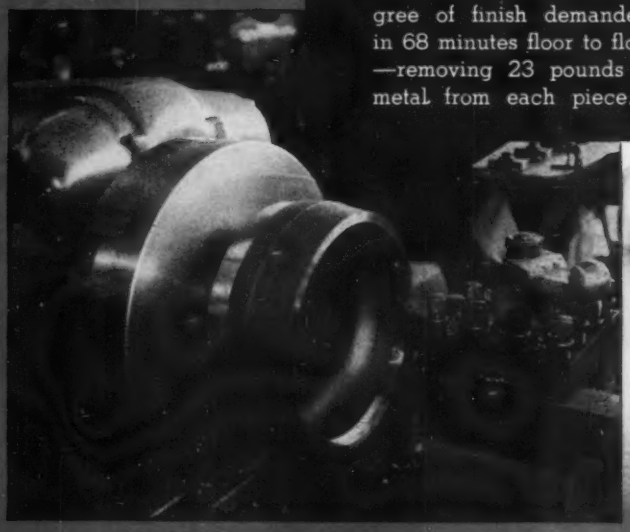
The answer . . .

"AMERICAN"

HYDRAULIC DUPLICATING LATHES



These pieces are now machined inside and out from the rough forging, with the accuracy and degree of finish demanded, in 68 minutes floor to floor —removing 23 pounds of metal from each piece.



The simplicity and dependability of the duplicating equipment plus the power and sturdiness of the "AMERICAN" Lathe proved just the right combination for this difficult job.

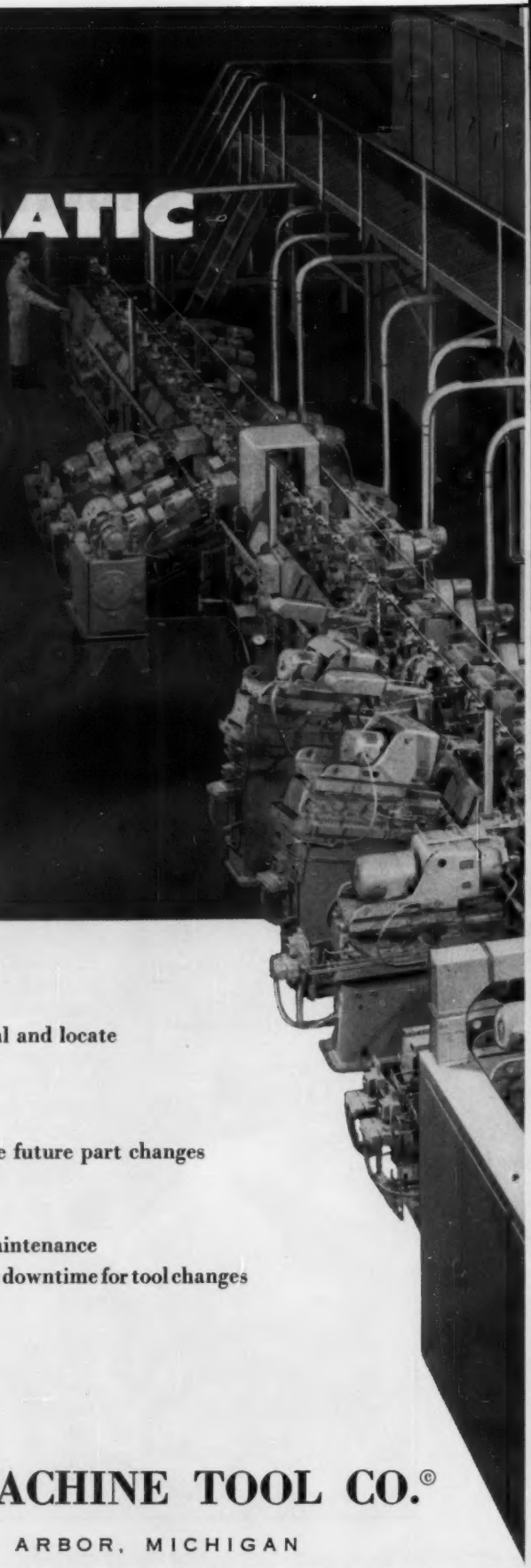
We specialize in "tough ones" —better ask us about your "problem" jobs.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

Buhr ECONOMATIC

performs 84 operations every 21 seconds!



- Elevated electric installations
- Central graphic-control panel
- Exclusive Buhr Detector System in main console to signal and locate electrical failures instantly
- Telephone system with plug-in stations throughout
- Fixtures pressure-cleansed on return
- Distinctive Buhr Sectional-Base Construction to facilitate future part changes
- Central mist-lubrication on all heads
- Automatic lubrication of all moving parts
- Standard and special parts interchangeable for ease of maintenance
- Spindles arranged for pre-setting of cutting tools to minimize downtime for tool changes
- Hardened-and-ground steel ways
- J.I.C. Standards throughout

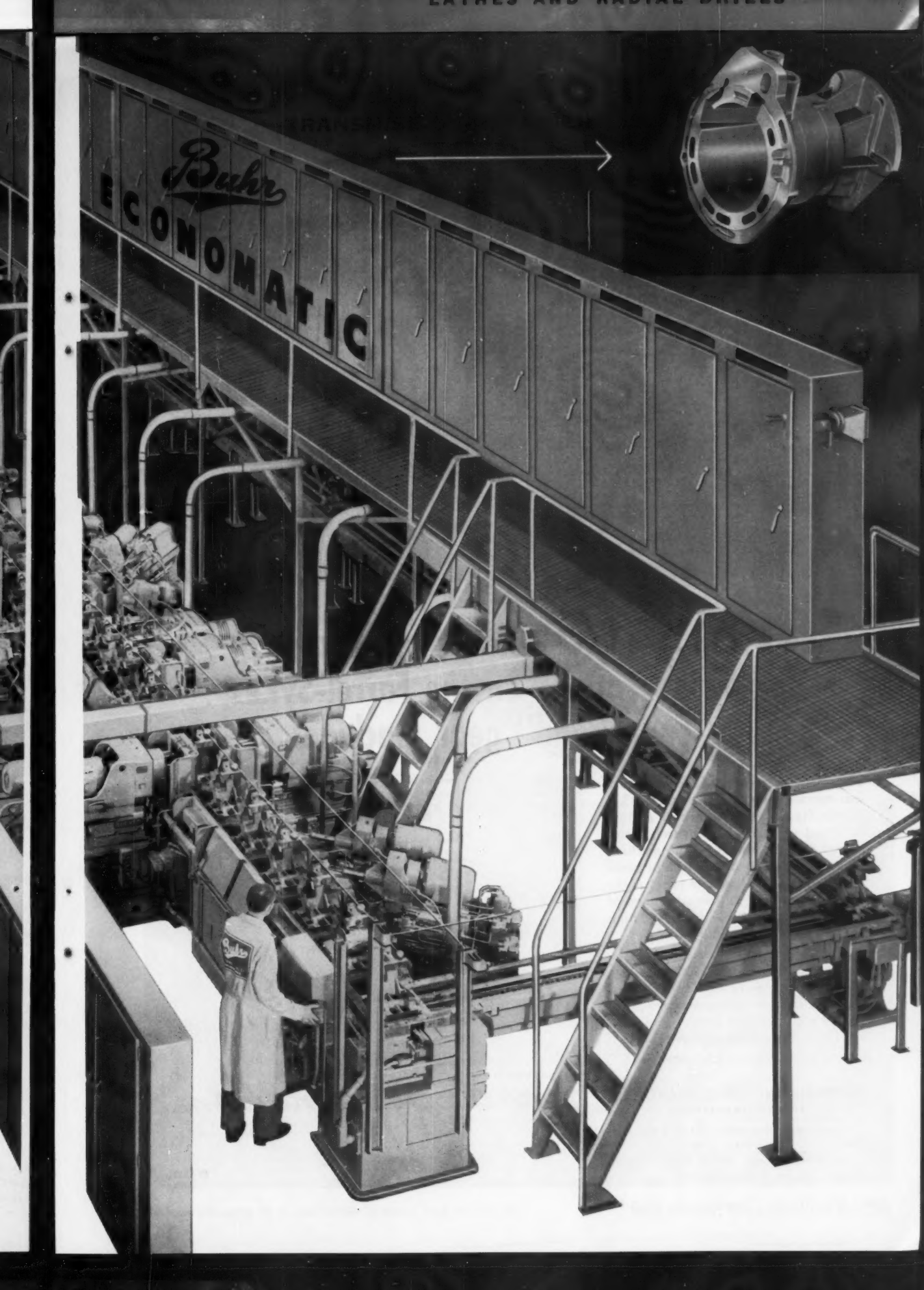
Buhr

MULTIPLE-SPINDLE HIGH PRODUCTION MACHINERY

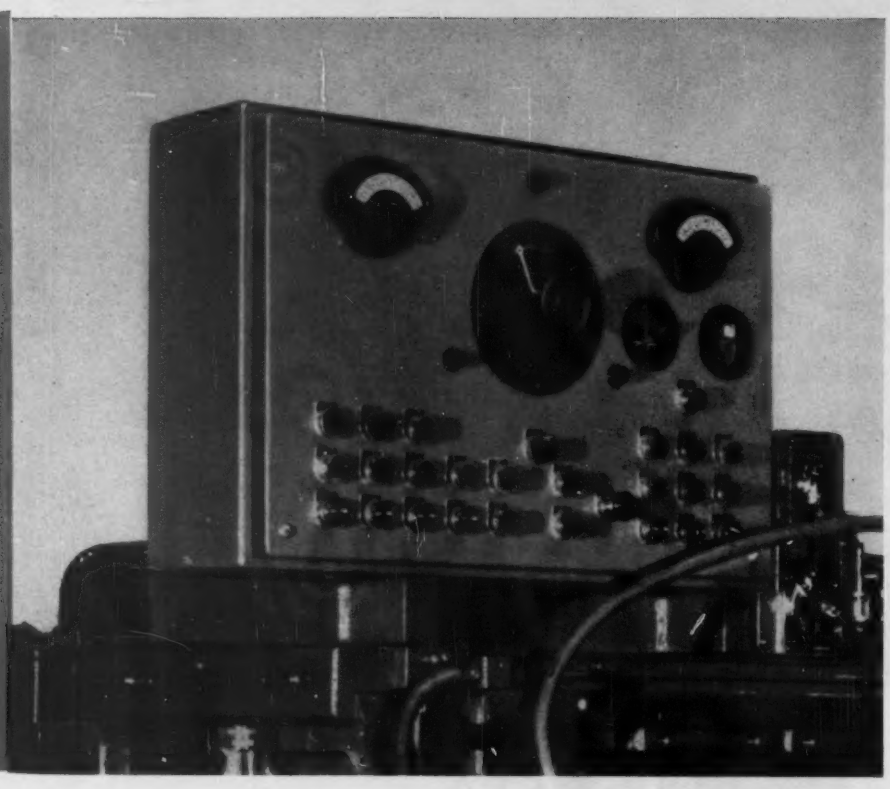
BUHR MACHINE TOOL CO.©

ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers


Buhr
ECONOMATIC

- RPM of main crank controlled by rheostat; indicated on meter. By pressing a button, RPM is converted to a direct reading in feet per minute of the slide.
- Meter indicates strokes per revolution of cutter, and is adjustable by flow-control valve. This enables operator to select any rate within machine's range.
- Work can be fed to cutters at any rate desired. Saddle is clamped and unclamped to main bedways by pushbutton control.
- Pilot lights protect against: (1) low pressure in lubrication system; (2) low pressure on the cutter head relief; (3) operating machine with cutter head clamp unlocked.

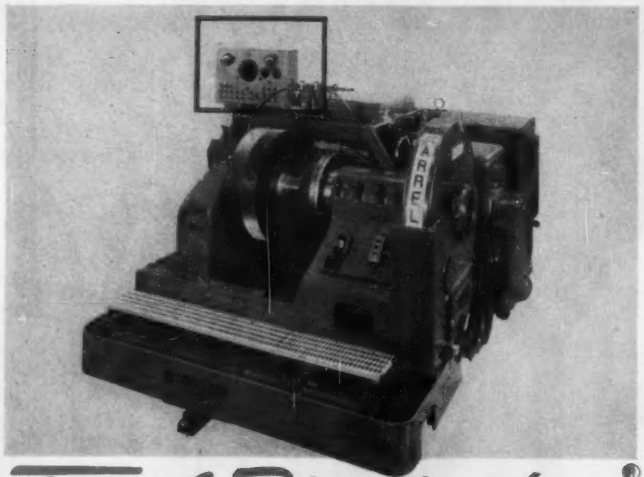


NOW... complete electrohydro control for all operations on the Farrel-Sykes "Twin-Head" gear machine

To provide the most precise and convenient operating control, the Farrel-Sykes "Twin-Head" gear generator is now equipped with an electrohydro control system. For all functions, the machine responds instantly to the touch of pushbuttons located on a single panel at the operator's station. Fullest advantage of the machine's extreme accuracy and high production speed is obtained.

Another outstanding advantage of the Farrel-Sykes machine is its versatility. It cuts every type of herringbone gear, single helical and spur gears, two members of a cluster gear at the same time, and other toothed and cylindrical forms.

Send for additional information.



Farrel-Birmingham®

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

Sales Offices: Ansonia, Buffalo, Akron, Chicago, Los Angeles, Houston

FB-1060

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dealers across the nation

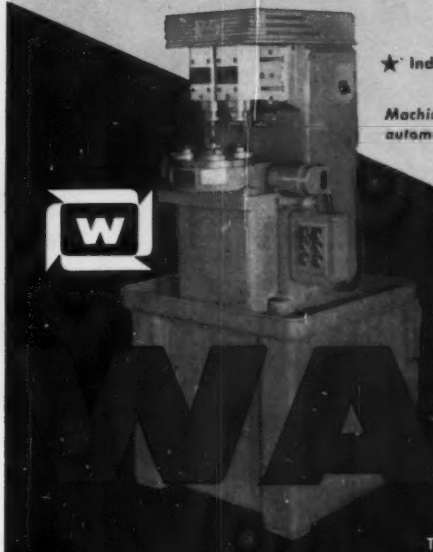
Wadell Vertical Precision Boring Machines, Automatic Indexing Tables, High Precision Spindles and Complete Tooling Services are available nationwide through these exclusive dealers.

Contact the dealer nearest you to discuss your small lot or high production requirements adapted to the VBM, (boring, facing, turning and chamfering). He will give you details and cost of the "Production Package".

In any case, we urge you to investigate the many advantages the compact VBM can offer you at reasonable cost.

★ Indicates sales offices

GREGORY RUFFA ADVERTISING



Machine illustrated with automatic indexing table completely tooled.

W

WA

EQUIPMENT COMPANY

TERMINAL AVENUE • CLARK, NEW JERSEY

for further information contact the dealer nearest you

★ Atlanta, Ga., Allison Machinery Co.; Buffalo-Rochester, N. Y., G. W. Brunton & Son, Inc.; Chicago, Ill., Milwaukee, Wis., Minneapolis, Minn., Bryant Machinery & Engineering Co.; Boston, Mass., General Machinery Corp.; New Haven, Conn., New York, N. Y., Giebel, Inc.; Philadelphia, Pa., Lemuel R. Lance Co.; Grand Rapids, Mich., Joseph Monahan Co.; Indianapolis, Ind., Toledo, O., Oatis Machinery Co.; Portland, Ore., Portland Machinery Co.; Los Angeles, Cal., Seaboard Machinery; Dayton-Columbus-Cincinnati, O., The Seifreat-Eistad Machinery Co.; San Francisco, Cal., M. A. Sherritt Co.; Syracuse, N. Y., H. A. Smith Co.; Cleveland, O., Pittsburgh, Pa., Wm. K. Stamets Co.; Detroit, Mich., Chas. A. Strelinger Co.; Scottsdale, Ariz., Wilson Machinery Corp.; Montreal-Toronto, Quebec, Windsor, Ottowa, Canada, Williams & Wilson, Ltd.

How would you take hold of this job to produce 426 parts per hour gross at $1\frac{5}{10}$c per part?

WIRE CUTTER HALVES

Steel Forging

426 pieces per hour gross - $1\frac{5}{10}$c per piece

FIRST CHUCKING

STA. 1V: Drill

STA. 2V: Ream

STA. 3V: C'sink

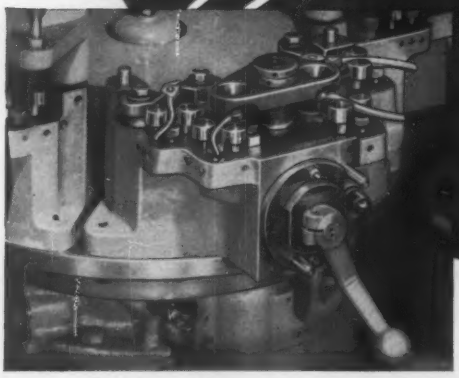
SECOND CHUCKING

STA. 1V: Rough C'bore

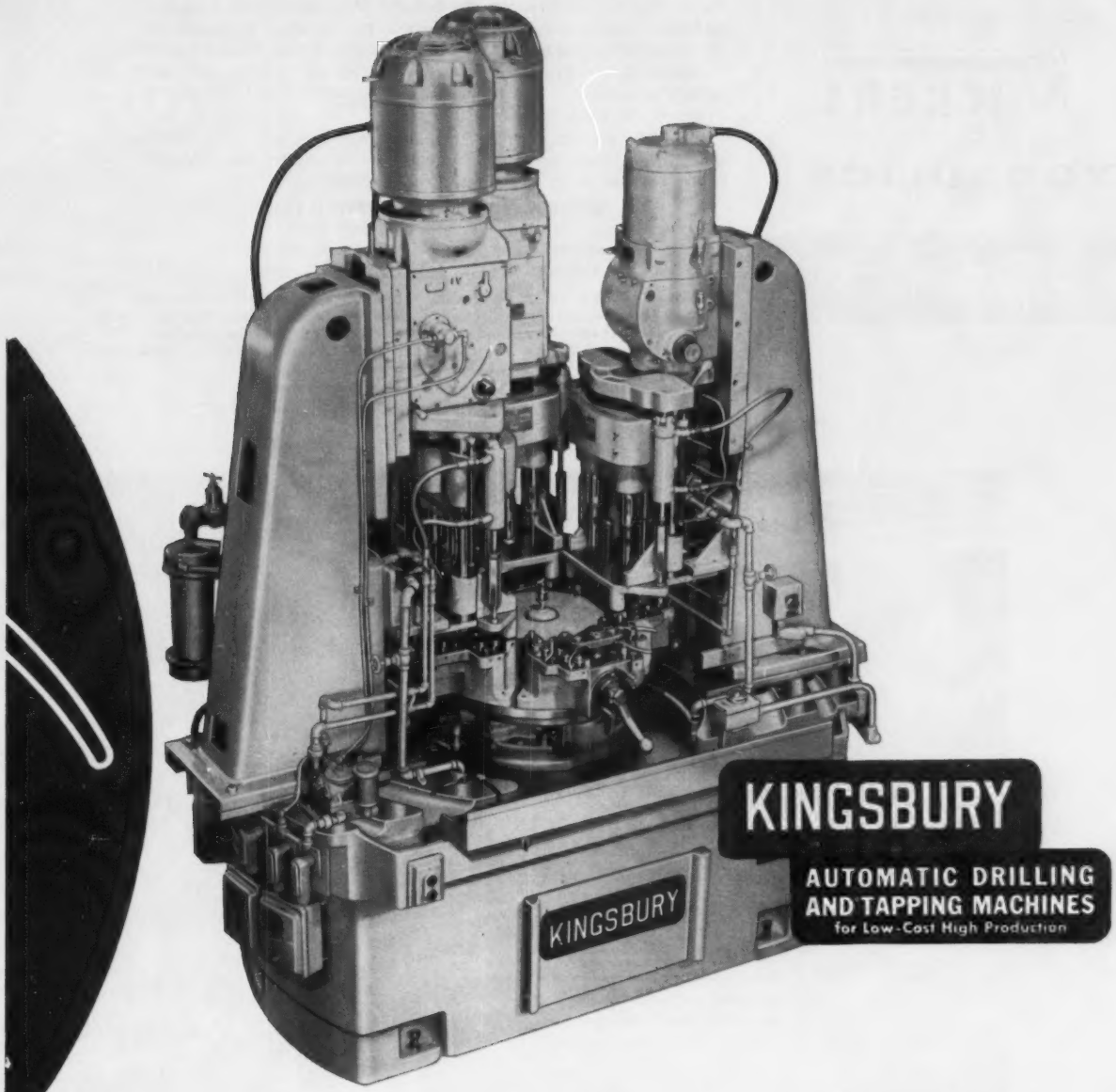
STA. 2V: Finish C'bore

STA. 3V: C'sink

"Operations Kingsbury"



Close-up of one of the four work-holding fixtures, each of which presents four plier halves for accurate drilling, boring, reaming and countersinking operations — to the tune of 426 parts per hour gross.



produce more parts, accurately, for rapid assembly

There's no room for *play* in a pair of pliers — no room for waste in their manufacture. All *like* halves must be interchangeable.

These requirements call for *precision with speed* — obviously a job for controlled multiple operations.

Print called for work on each side of two halves. It was decided to accomplish this with two chuckings, each work-holding fixture holding 4 parts — two lefts and two rights. In the first chucking, vertical units at Stas. 1, 2, 3 drill, ream and countersink the axis hole.

At Sta. 4 each part is turned over and placed in the second chucking. Two new parts are placed in the first chucking.

On the second and succeeding cycles all four parts are worked upon simultaneously. Stas. 1, 2, 3 rough- and finish-bore and countersink the parts in the second chucking, while parts in the first chucking are drilled, reamed and countersunk.

This uniform accuracy is not as simple as it sounds. Each of the four work-holding fixtures must be identical to locate each piece correctly at every station. This precision, this careful planning, is characteristic of Kingsbury machines, *custom-built at Keene, New Hampshire.*

Kingsbury Machine Tool Corp.
119 Laurel St., Keene, N. H.

For more information fill in page number on Inquiry Card, on page 231

Another Example of

VICKERS®

HYDRAULICS

in Automation

Ex-Cell-O Precision Cylinder Boring Machines shown below are finish-boring V-8 engine blocks. Like so many other high-production machines, these make generous use of hydraulics.

In addition to the advantages inherent in hydraulic control, Vickers Hydraulics gives you the benefits of a nation-wide company-operated field engineering and service organization to assure correct application and operation with least maintenance. Vickers has the complete line of hydraulic equipment necessary to take undivided system responsibility . . . to eliminate any risk of incompatibility of hydraulic components.

The Vickers Application Engineer near you will be glad to demonstrate the many benefits you can obtain by using Vickers Hydraulics. Write for a copy of Catalog 5002B.

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

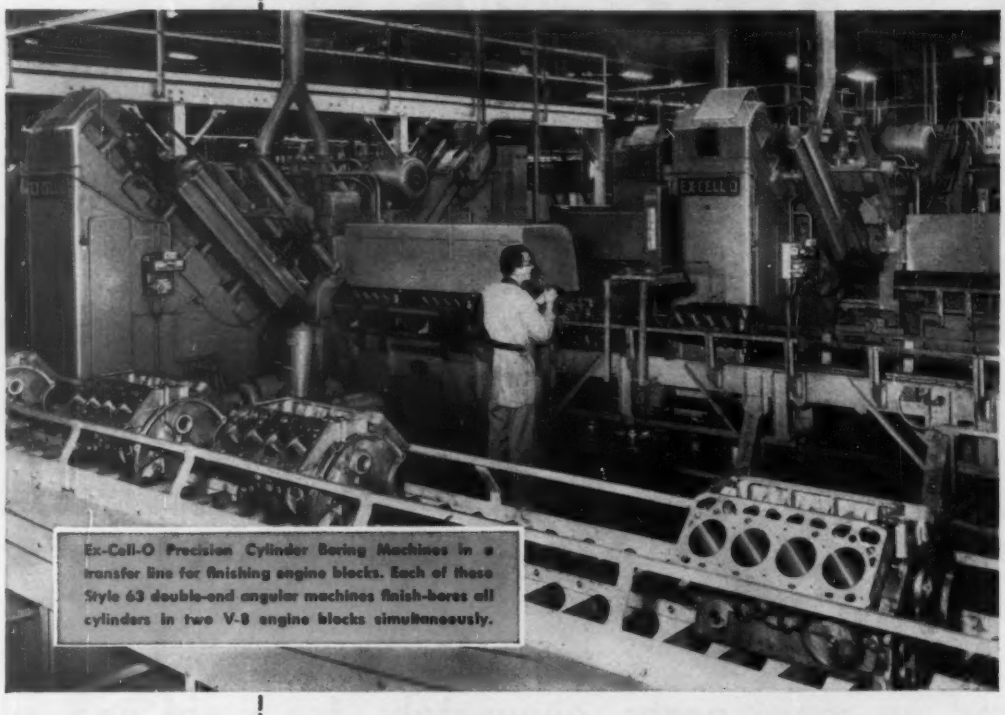
ADMINISTRATIVE and ENGINEERING CENTER

DEPARTMENT 1403 • DETROIT, 32, MICH.

Application Engineering Offices: **• ATLANTA • CHICAGO • CINCINNATI • CLEVELAND DETROIT • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Summit, N.J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS TULSA • WASHINGTON • WORCESTER**

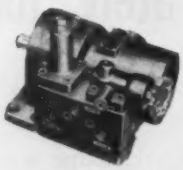
IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

Engineers and Builders of Oil Hydraulic Equipment Since 1921



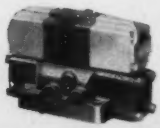
Ex-Cell-O Precision Cylinder Boring Machines in a transfer line for finishing engine blocks. Each of these Style 63 double-end angular machines finish-bores all cylinders in two V-8 engine blocks simultaneously.

Representative VICKERS® Units Used on Ex-Cell-O Precision Cylinder Boring Machines



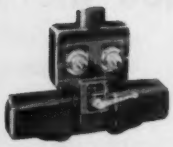
Two-Pressure Pump

Insures lower maintenance cost and saves horsepower and heat in two-pressure hydraulic circuit. Automatically provides high volume at low pressure and low volume at high pressure.



Solenoid Controlled Pilot Operated 4-Way Valve

Compact and versatile "sandwich" construction. Gasket mounting simplifies installation and overhaul . . . also minimizes piping.



Traverse and Feed Cycle Control Panel

Maintains smooth and constant preset feed rate regardless of fluctuations in cutting tool resistance or hydraulic pressure.

7350

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"Red Tang"
AMERICAN PATTERN
FILES and RASPS
For general or special purpose machine shop filing; saw sharpening; and for use on wood, leather and soft metals.
SIMONDS
NOW...
SIMONDS
has a Complete Line
of "Red Tang" Files!
Simonds now offers you all types of files in the Right Length, the Right Shape and the Right Cut for every filing job. What's more, Simonds Files are Grade A. First Quality only . . . backed by Simonds reputation for outstanding quality, dependability and service.
American-Swiss
SWISS PATTERN
FILES
For precision work where the craftsman's delicate touch is a matter of pride and profit.
SIMONDS
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For Fast Service
from
Complete Stocks
Call your
SIMONDS
Industrial Supply
DISTRIBUTOR
ROTARY FILES
For power driven filing in tool and die shops, pattern shops, aircraft and automotive plants, machine shops, foundries.
VIXEN
Milled Curved-Tooth
FILES
For fast, smooth work on lead, babbitt, zinc, aluminum, bronze, plastics, cast iron and steels — everywhere.

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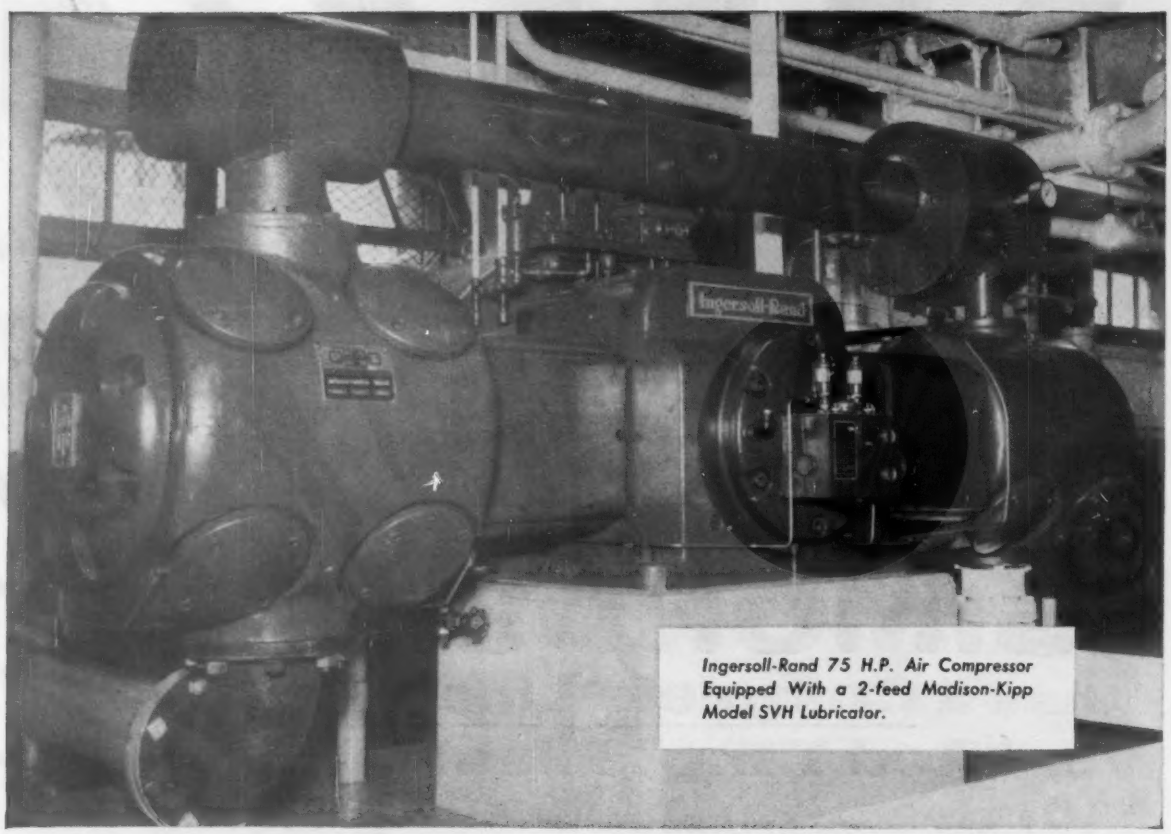


Ingersoll-Rand 75 H.P. Air Compressor Equipped With a 2-feed Madison-Kipp Model SVH Lubricator.

Machines of great performance use the most dependable oiling system ever developed

MADISON-KIPP

Fresh Oil ... by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy, where oil under pressure fed drop by drop can be installed. There are 6 models to meet almost every installation requirement.

kipp

MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WIS., U. S. A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

New 6" x 18" hand feed

Thompson Grinder

FOR SHOPWORK
OR TOOL ROOM

Completely anti-friction and permanently lubricated machine. Available with all types of attachments found on tool room surface grinders including interchangeable horizontal and vertical wheel heads. A Thompson high quality precision machine at this low price.

LOW PRICE* HIGH QUALITY

PRECISION PETE says:

FOR LOW COST AND QUALITY YOU JUST CAN'T BEAT THOMPSON
Make your next hand feed grinder a Type D Thompson . . . write today for the new descriptive catalog, D-55

* Write today for quotation

Call, write or wire today

Thompson Grinders

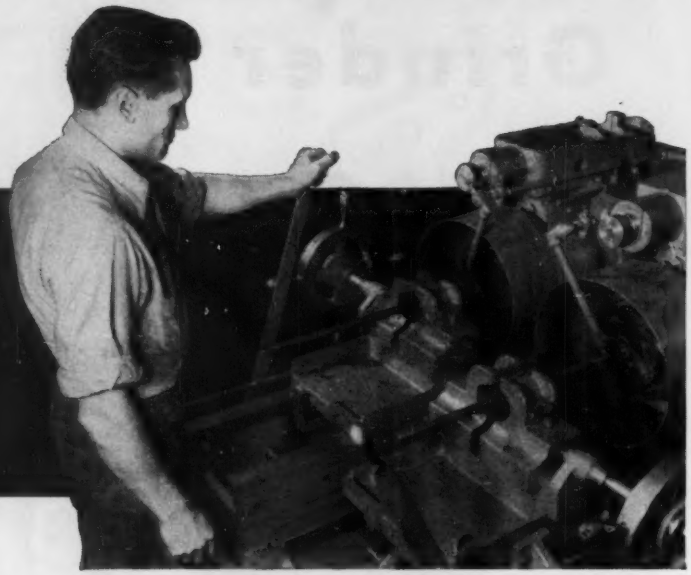
The Thompson Grinder Company at Springfield, Ohio

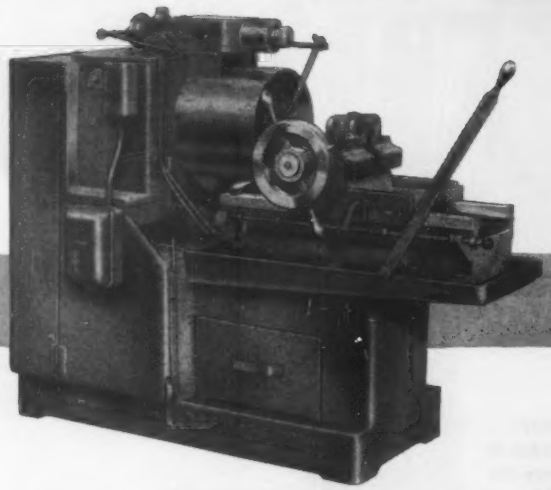
For more information fill in page number on Inquiry Card, on page 231

The Acme model XLA Threading Machine

A new addition to the HILL ACME line of heavy duty precision equipment – RUGGED, ACCURATE, LOW PRICED

The ACME Model XLA Threader is a low cost, heavy duty threading machine designed for either maintenance work or for production operations when equipped with automatic features. The ACME XLA is built in single and double spindle design in sizes of 1", 1½", 2" and 2½" capacity.





ACME Model XLA Threaders can be equipped with either the "HILLCO" Tangential Die Head, for production work, or with the "ACME" Hob Type head for maintenance operations. This precision machine with it's amazing versatility is priced to fit YOUR budget.

Bulletin XLA gives complete details.

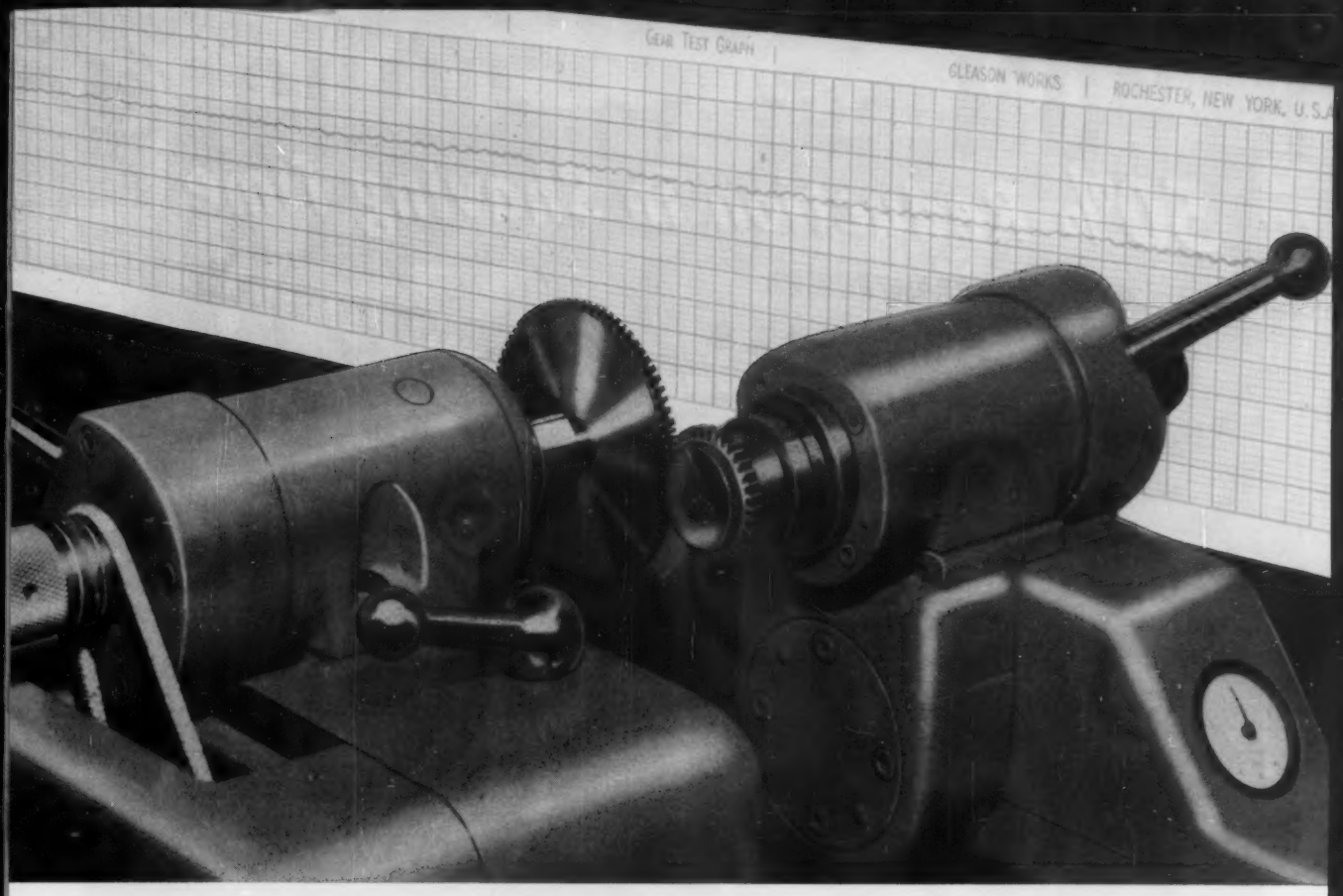
HILL ACME TOOLS FOR INDUSTRY

THE HILL ACME COMPANY

ACME MACHINERY DIVISION • 1209 W. 65th St., Cleveland 2, Ohio

ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING & POLISHING MACHINES HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES



Make a complete test and record of your small spur and helical gears

You can be certain that your spur and helical gears will operate correctly in their final mountings if you give them a complete test *before* actual assembly.

The new Gleason No. 104 Spur Gear Tester gives you a complete check of your gears. A rolling test for composite error provides a quantitative check of tooth spacing, profile shape and runout.

In this test, the gears are slowly rotated while a calibrated spring load keeps them in metal-to-metal contact. Any error in the gears results in a horizontal movement of the drive spindle. A completely electronic pickup and recorder make a *permanent* chart of the results.

But there is still another test you can make with the No. 104 Tester—a running test, which simulates actual operating conditions, determines the smoothness of operation, noise characteristics, and tooth contact, which will actually be obtained when the gears are used.

This machine tests precision and commercial gears up to 4½" center distance.

We will gladly furnish further information on the No. 104 Spur Gear Tester. Write for our bulletins.

The No. 104 Tester is furnished complete with an electronic pickup and recorder unit, as shown above.

GLEASON WORKS

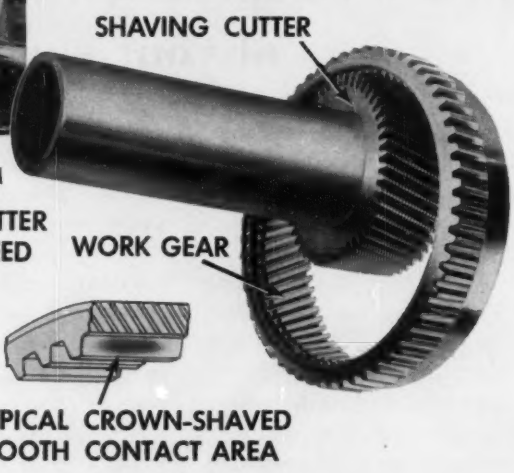
Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

81

50% Reduction in Shaving Time

of CROWNED INTERNAL GEARS by NEW PLUNGE-CUT PROCESS



This typical internal automatic transmission gear is crown-shaved in 24 seconds machine time with the tooling shown.

Amount and position of crown for any specific work unit is optional.

The Plunge-Cut Process is equally applicable to straight-tooth gears and with the same economy in shaving time.

If you are mass-producing internal gears, write for Bulletin S55-6 on Internal Gear Shaving Machine, Model GCR

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

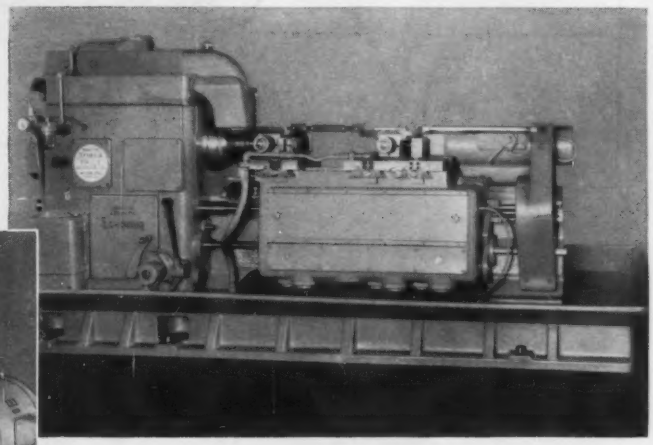
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

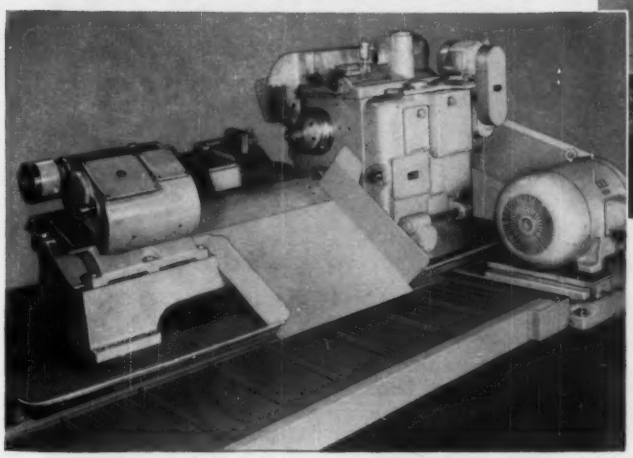
For more information fill in page number on Inquiry Card, on page 231

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

NEW SENECA FALLS DESIGN SOLVES CHIP DISPOSAL PROBLEM





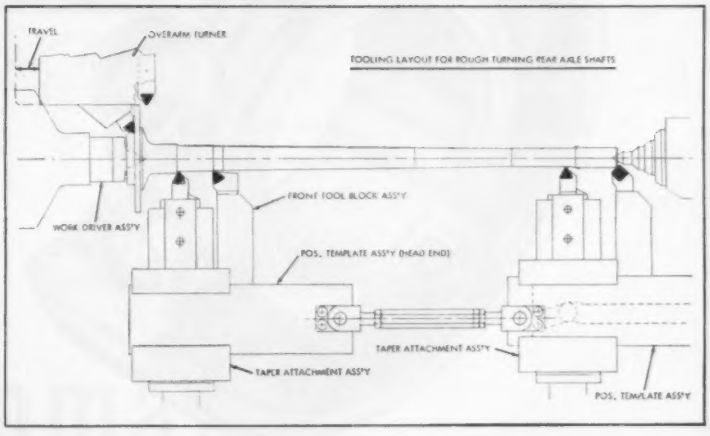
PROBLEM: To eliminate machine down time due to chip accumulation in the tooling area and pan of lathes required for a high production rear axle shaft job.

SOLUTION: To promote rapid flow of chips from the edges of the cutting tools, Seneca Falls engineers designed a special "Chip Flow" type bed for the otherwise standard Model AR Automatic Lo-swing Lathe.

The rear view illustration shows that the usual back shelf has been eliminated in the chip area and replaced with a smooth, steep angle slope which assures an uninterrupted flow of chips from the edges of the cutting tools into the mechanized chip conveyor at the base of the machine. Auxiliary attachments are mounted overhead instead of on the usual back shelf. An auxiliary, cam-operated turning slide mounted on the headstock is used for turning the outside and pilot diameters of the shafts. Facing slides can be supplied to replace this attachment.

High spindle speeds and coarse turning feeds assure a production of 153 shafts per hour with Automatic Work Handling Equipment.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.



PROFIT ENGINEERED BY SENECA FALLS

FACTS

about

NEW DEPARTURE

BALL BEARINGS

Self-sealed bearings simplify design . . . cut maintenance costs

New Departure originated self-sealed ball bearings to eliminate the most common causes of bearing wear and failure—such as abrasive dirt and improper lubrication. Since then, more than 300,000,000 New Departure sealed bearings have been produced in various types to fit the specific requirements of industry. Seals are available to keep out foreign matter, ranging from dust and dirt to corrosive gases . . . to retain lubricants, varying from heavy grease to light oil . . . to provide the protection that assures longest life.

New Departure's latest advance, Sentri-Seal, embodies exclusive features which importantly improve both bearing performance and range of application. Because of its design, Sentri-Seal provides controlled, highly efficient sealing with low torque and is not materially influenced by axial movement due to bearing end play within prescribed tolerances.

Sealed ball bearings offer the electric motor and machine tool builder many advantages. They simplify design, make it possible to mount motors in any position, cut maintenance to a minimum, and eliminate the need for relubrication for long periods of operation.

WRITE FOR COMPLETE INFORMATION ON NEW DEPARTURE SEALED BEARINGS!

NEW DEPARTURE • DIVISION OF GENERAL MOTORS CORPORATION • BRISTOL, CONN.

61 models

A machine not put to its best use is theoretically idle. Proper machine selection is an important factor in the profitable use of a multiple spindle automatic. So extensive are the demands on this type of lathe that no single model—or number of models—can be expected to efficiently handle the wide range of work available.

To excel in any range of work a multiple spindle automatic must be specifically designed for that range. That is why CONOMATICS are provided in so many models. In no other way can the purchaser be assured of the best possible machine for his particular requirements.

Write for your copy Today

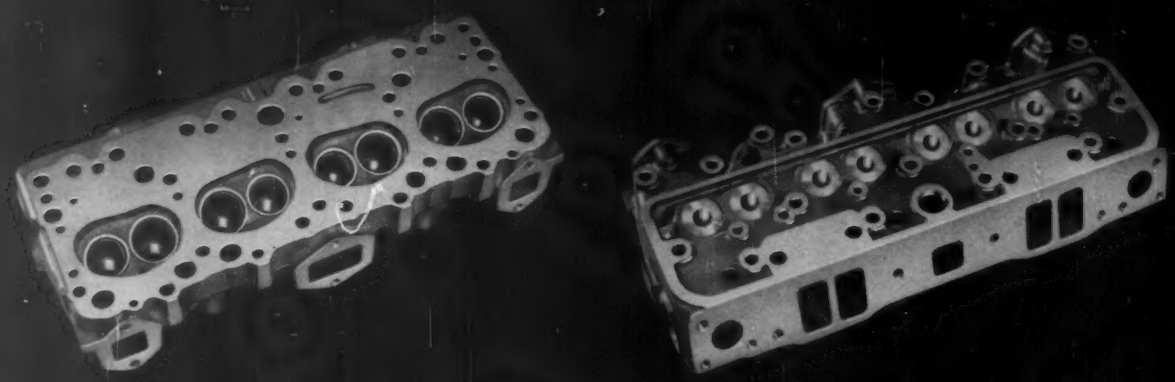
Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

Introducing

Sectionized Automation with *Automatic Banking* for V-8 Cylinder Heads

Section III



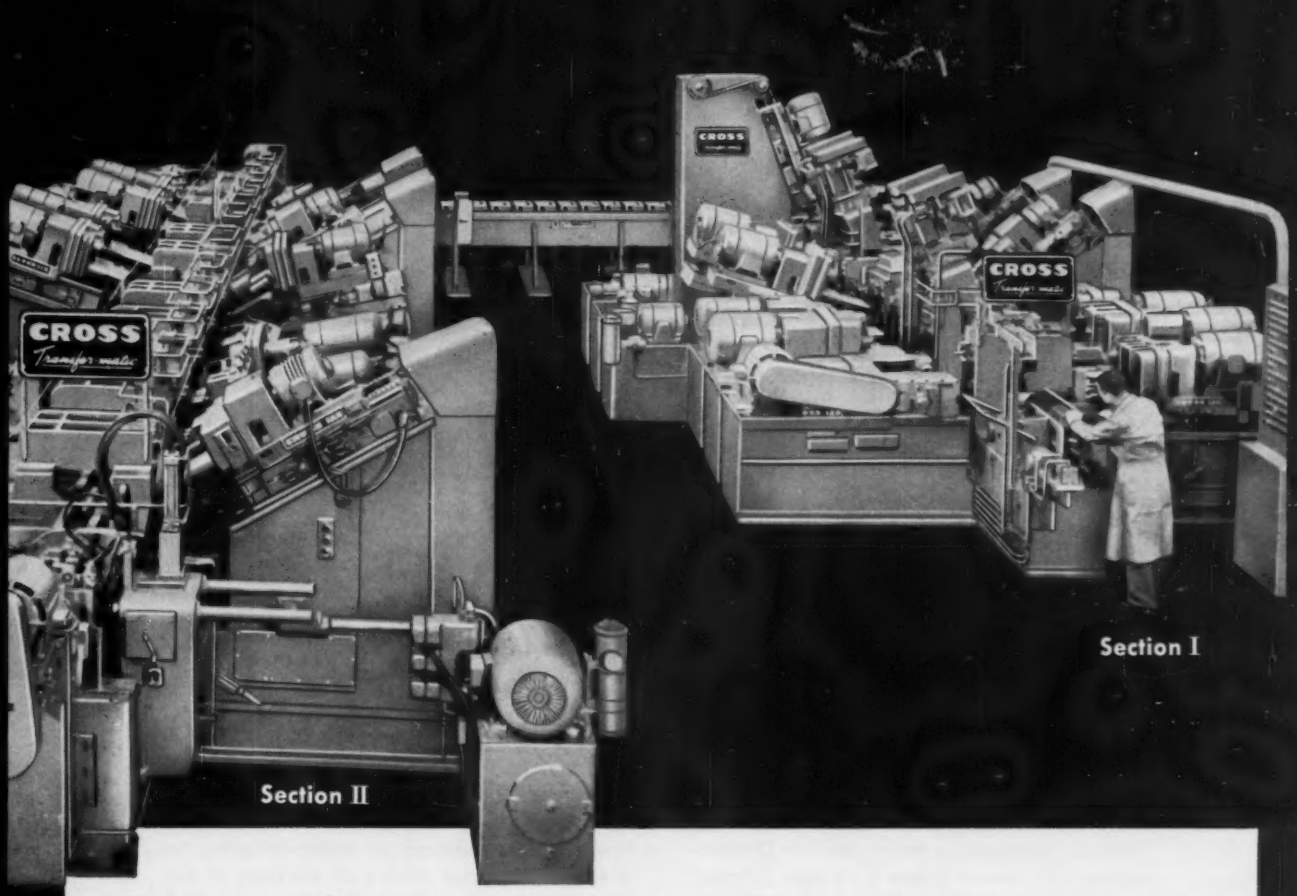
Established 1898

THE CROSS CO.

First in Automation

DETROIT 7, MICHIGAN

Another Automation First by Cross



This *Sectionized* Transfer-matic for machining V-8 cylinder heads is the first in the industry to utilize automatic banking to reduce downtime.

Key to the increased operating efficiency of this machine is its division into three sections and the use of two banking units—one at the rear between Sections I and II and the other in front between Sections II and III.

The first banking unit holds up to 35 pieces and feeds Section II. The second feeds Section III.

If production is interrupted in Section I for tool changing or maintenance, Sections II and III continue to operate as they receive parts from the two banking units. If Section II is stopped, the first banking unit stores the overflow from Section I and the second unit continues to feed Section III. If work in Section III is interrupted, the second banking unit receives and stores the parts from Sections I and II. The ability to shut down any one of the sections while the others continue to operate results in greatly increased production efficiency.

The entire line performs 461 operations on each of 144 cylinder heads per hour at 100% efficiency—213 in the 11 stations of Section I, 154 in the 16 stations of Section II and 94 in the 13 stations of Section III. This completes all operations except broaching.

Other features are: Construction to JIC standards, hardened and ground ways, automatic lubrication, automatic chip disposal, pre-set tooling throughout and Cross Machine Control Units to program tool changes.

New

AIR COUNTERBALANCE SWIVEL ATTACHMENT

FOR RADIAL DRILLING MACHINES

THIS IS ANOTHER FIRST FOR THE U. S. DRILL HEAD COMPANY

This new combination Swivel and Air Counterbalance attachment makes it possible to adapt large multiple spindle drill and tapping heads to radial drilling machines.

Flexible and easily adjusted, it insures maximum safety for the operator, as well as better operating economy.

Two cylinders maintain a balanced condition of the head of the machine, with the air in the counterbalancing setup being controlled on both ends of the stroke. Therefore, only sufficient pressure is maintained to counterbalance the weight of the head during all portions of the stroke. On the return stroke, the air is controlled to prevent extreme, quick return of the head. Attachment includes air filter, pressure regulator, and an air oiler, and incorporates a 360° swivel feature fully aligning the drill head. It operates equally well with the fixed center type head and the adjustable type head.

This package is ideally suited for drilling condenser plates, boiler tube sheets, flue sheets, etc.

FOR MEN WHO KNOW DRILL HEADS BEST, IT'S ALWAYS U. S. DRILL HEAD — FIVE TO ONE

Manufacturers of all types of Fixed Center, Adjustable, and Individual Lead Screw Tapping Heads.

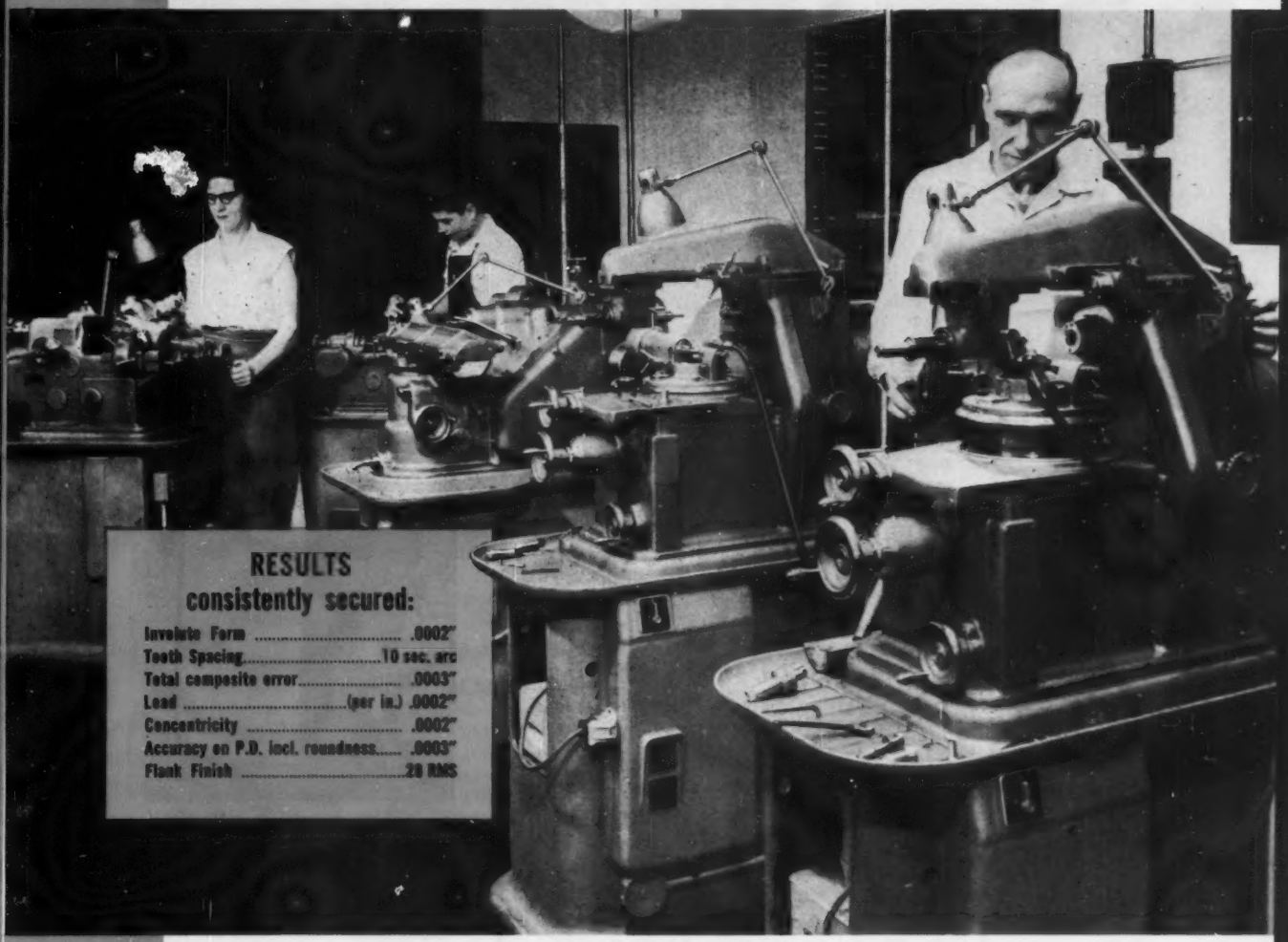
US DRILL HEAD

THE UNITED STATES DRILL HEAD COMPANY

BURNS STREET • CINCINNATI 4, OHIO

For more information fill in page number on Inquiry Card, on page 231

FOR many years The FRANKE GEAR WORKS, Inc. of Chicago have specialized in the manufacture of fine pitch gears and gear assemblies. When they wanted more precision, they selected the MIKRON as the ultimate! The illustration shows a portion of a MIKRON cutting department which contains practically the whole range of MIKRON types... for spur, helical, cluster, internal, bevel, racks and thread milling, worms, worm gears and tangential hobbing of throated worm wheels.



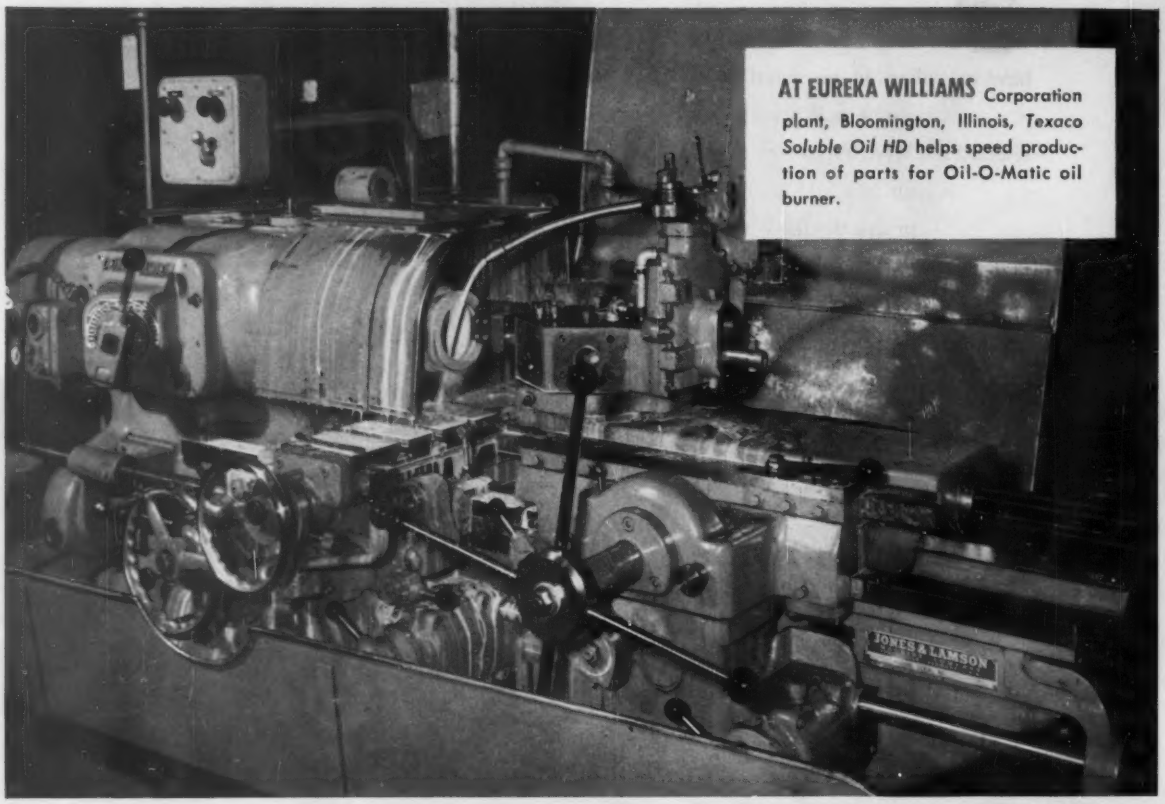
RESULTS consistently secured:

Involute Form	.0002"
Tooth Spacing	10 sec. arc
Total composite error	.0003"
Lead (per in.)	.0002"
Concentricity	.0002"
Accuracy on P.D. incl. roundness	.0003"
Flank Finish	28 RMS

FRANKE chose MIKRON over all other available machines because of repetitive accuracy obtainable ... and without need for laborious and costly nursing of jobs!

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.



AT EUREKA WILLIAMS Corporation plant, Bloomington, Illinois, *Texaco Soluble Oil HD* helps speed production of parts for Oil-O-Matic oil burner.

Eureka Williams' experience shows how you can

INCREASE PRODUCTION
REDUCE COSTS

"Ours is the oldest name in automatic heating," says Eureka Williams Corporation, "and a big factor in maintaining our position in this highly competitive field has always been our ability to keep our production quality up and our costs low.

"Texaco Cutting, Grinding and Soluble Oils – which we have used for more than ten years – have helped us a lot by giving us exceptionally long tool life, eliminating rusting problems and assuring better finish."

Why not enjoy these benefits in your plant? There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to help you do all your machining better, faster and at lower cost. A Texaco Lubrication Engineer will gladly help you select the proper ones.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

EUREKA WILLIAMS Oil-O-Matic Warm Air Furnaces feature "sealed in steel" construction for cleaner heat, new heat exchanger designed to cut fuel bills. Eureka Williams also makes Gas-O-Matic and Air-O-Matic heating and air conditioning units. Parts for all of them are machined with *Texaco Cutting, Grinding and Soluble Oils.*

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

For more information fill in page number on Inquiry Card, on page 231

- **Congressional antics before adjournment**
- **Divided highway ahead — 41,000 miles**
- **Washington cuttings**

Keeping up with Washington

By Loring F. Overman

IN the days before adjournment, Congress was pulling some surprising political rabbits from under the Capitol dome. Hours before adjournment, figuratively speaking, Congress was making decisions which will affect the national economy for years to come. Observers trying to square Congressional action with party policy found many situations baffling.

The Administration wanted a moderate expansion of social security coverage. Congress approved a broad program reducing the optional retirement age for 800,000 women to 62 from 65; authorized payments of social security benefits to 250,000 disabled workers in covered occupations at age 50; and approved an increase of 1/4 per cent in social security taxes payable by both the employer and employe . . . to a total of 2.25 per cent.

The Administration opposed a public power move to construct Hell's Canyon Dam in Idaho with federal funds; members of Congress crossed party lines to support the Administration viewpoint.

Senate and House conference committees approved a compromise version of H.R. 11526, implementing many Hoover Commission recommendations for trimming the fat out of federal spending. Since official Washington is traditionally cool to proposals for curtailing functions or personnel, Congress' action is considered encouraging. Less optimistic observers point out that it is politically expedient to vote for economy in government, just weeks ahead of elections.

A case in point is the Treasury's July announcement of a $1,700,000,000 surplus for the fiscal year ending July, 1956. The Administration had hoped for a surplus twice that amount, and there were hopes for a time that a surplus of $3,000,000,000 to $4,000,000,000 would allow reduction of income taxes. Latest view—"not yet."

The best bet for an income tax reduction is to support the Hoover Commission proposals included in H.R. 11526. These proposals project savings of $5,000,000,000 in government expenditures if certain recommendations are carried out. Savings of such magnitude will be required to offset budget increases foreseen for the fiscal year ending June 30, 1957. Any increases above the $66,000,000,000 estimated last January stem from expenditures authorized by the 84th Congress. Among these are an additional $2,500,000,000 for farm price supports; withdrawal of $2,000,000,000 annually from the general fund for the new highway program; and $900,000,000 additional for defense.

Divided Highway Ahead—41,000 Miles

Machinery industries will be among several beneficiaries of the new 41,000-mile Interstate and National Defense Highway system on which approximately $38,000,000,000 will be spent in the next sixteen years. The largest civilian type program ever undertaken by the Federal government, it is expected to inspire related expenditures that will raise the project total to about $100,000,000,000. This program is expected to revolutionize the Nation's economic life by setting up a new pattern of work, recreation, and housing.

Machinery industries directly affected will be those building earth-moving and highway-construction equipment. Indirectly, makers of the machines which produce the highway-making equipment will participate actively —in other words, machine tool builders. The American Road Builders Association expects a heavy demand for tractors, cranes, shovels, concrete mixers, ditchers, rollers, asphalt pavers, trucks, and many other units. Over the life of the program, a need for $2,600,000,000 worth of new road-building machinery and equipment is indicated, with the heaviest purchases during the initial years.

Machinery will be needed to increase the output of such items as cement, aggregate, lumber, highway steel, and drainage piping. And, also, for fabricating the millions of dollars worth of factories, shopping centers, recreational areas, and housing projects expected to follow the 41,000-mile national network!

Washington Cuttings

- Costliness of push-button warfare is emphasized by new estimates of the probable defense budget for fiscal 1958. Even if $5,600,000,000 were saved by cutting 800,000 names from the Armed Forces payroll, the total budget would still be above $35,600,000,000 for 1956, and the estimated $37,000,000,000 for fiscal 1957, according to preliminary estimates.
- Small business firms are claiming an increasing share of government purchases, the Small Business Administration reports. During the fiscal year ended June 30, 1956, purchases earmarked for small firms were valued at $497,678,000. This total was $111,000,000 more than in fiscal 1955 and twice the value of purchases set aside for small business in 1954—the first year of SBA operation.
- Loans approved by the Small Business Administration during fiscal 1956 were more than double those of the previous year. Approvals for the year ended June 30, 1956 were 5224 for $126,379,521. Loans approved since the beginning of the SBA program in September, 1953 numbered 8112 for $218,707,621. Wider general knowledge of the program is one of the reasons for its increasing use, SBA observes.
- First allotment of nickel alloy to defense contractors under provisions of new regulations designating nickel as a controlled material has been announced by the Office of Defense Mobilization. The allotment covers the fourth quarter of 1956 and amounts to 28,850,000 tons.

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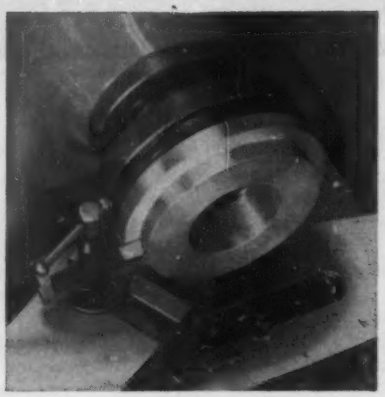

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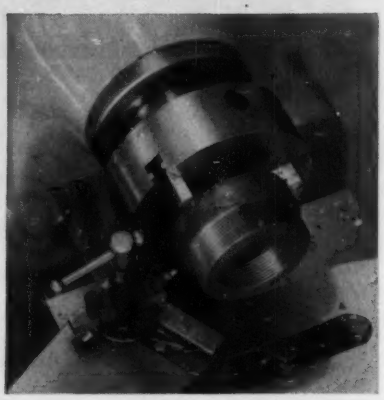

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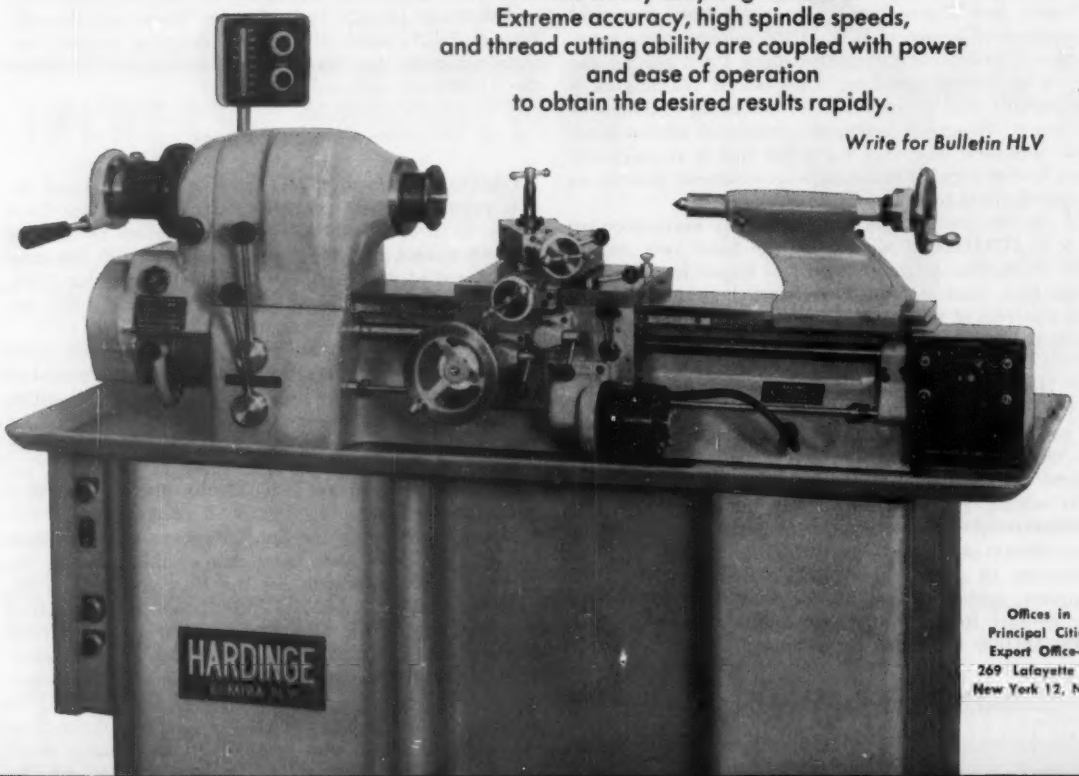

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MACHINERY
SEPTEMBER 1956

Doesn't the Public Care?

THE steel strike is now a matter of history. Employers and employes of the steel industry are again presumably cooperating, with relations on an even keel. However, there were certain disturbing factors about this strike that will probably be present on many future occasions.

One of them was the apparent disregard of public welfare on the part of union leaders. Here was a strike which affected not only the pocketbooks of the union members and the steel companies but thousands of other people besides. It has been estimated that for every steel company employe on strike, three or four men in other industries were thrown out of work.

Twelve steel companies recently reported that in three major strikes since 1946, workers in the steel industry alone lost $622,000,000 in wages, and the companies, 46,500,000 tons of steel production. These figures do not include the recent stoppage of steel production.

True, the orders that pile up during a strike provide a backlog for future operations when all companies of the same industry are facing a strike, and the strikers get some of their lost income back in overtime and increased paychecks. But, the dislocation of the national economy from such a strike is incalculable in the case of a long stoppage. The direct loss to the national economy from the 1952 strike alone was over four billion dollars.

If the steel workers had any serious grievance when the recent strike was called, it was never named by the labor leaders. By all accounts the workers were at or near the top so far as industrial wages were concerned. Far from refusing to discuss better terms, the steel companies made an offer which, if less than had been hoped for, was at least a substantial improvement over previous terms and would seem to have furnished a basis for further negotiations. Why then was the bargaining broken off?

There was a time when the general public would have been greatly aroused over an event that might have been akin to a catastrophe to a wide section of our economy. But in this instance, there were few expressions of concern by Government officials, business executives, or labor leaders. No stirring editorials appeared in daily newspapers —no demands for an investigation to determine impartially whether or not the strike was warranted and how it could be ended on an equitable basis.

There is no question as to the validity of a strike when workers' objectives are reasonable and manufacturers are adamant. However, there are an increasing number of strikes in which the actual disagreements between employers and employes are distinctly minor. Last year, one machine tool company underwent a disastrous strike that was called merely to determine which of three unions should have jurisdiction over the workers. There was no real grievance against the company.

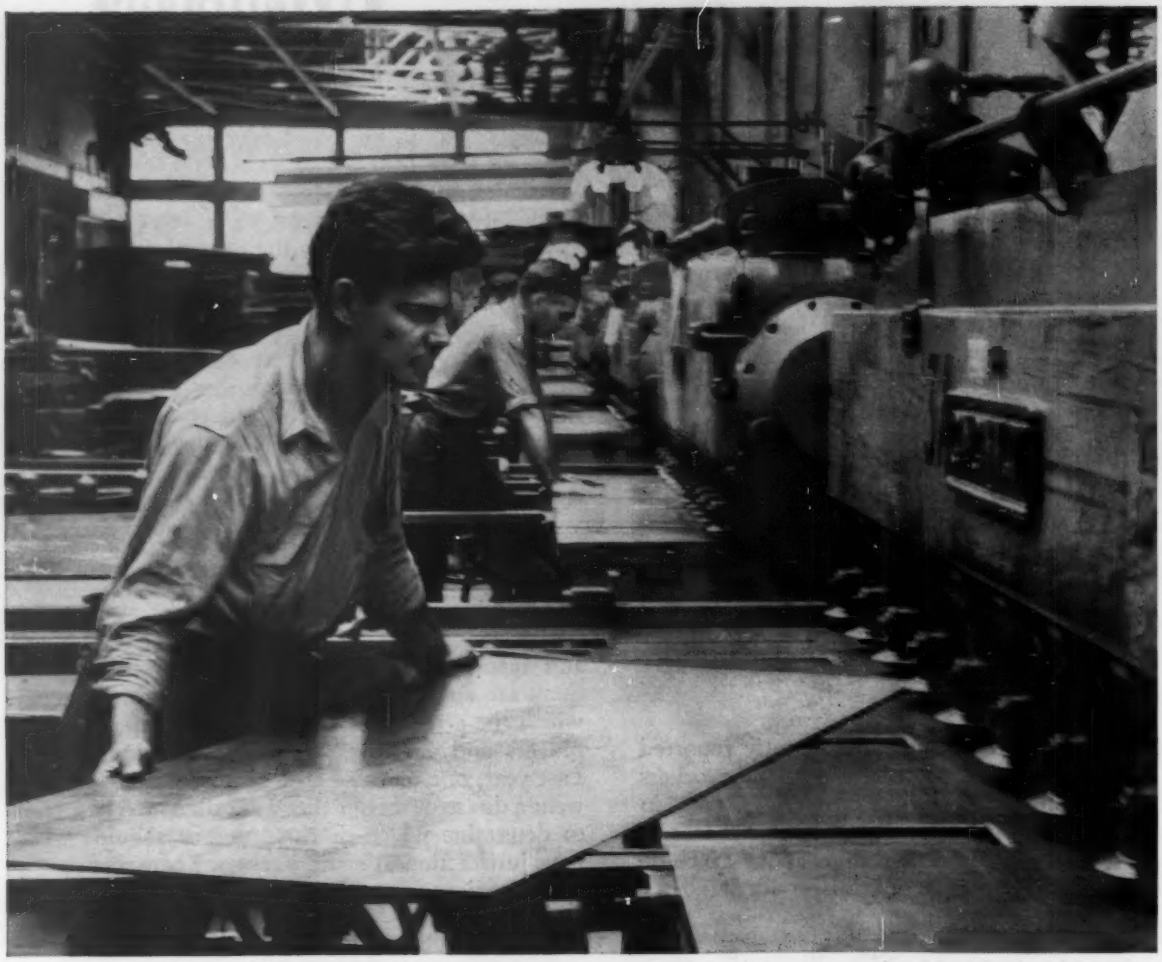
In the steel strike, the accusation was made that it occurred because of internal union politics—that pressure exerted by rival union leaders made it impossible to accept reasonable proposals offered by the steel companies.

Why should the nation at large face economic crises because of the personal ambitions of individual union leaders? Why should union members be kept in the dark as to the real motive for work stoppage and be compelled to accept income loss from unnecessary strikes? When will the general public become sufficiently aroused to bring such unfair tactics into disrepute?

The strike weapon is like dynamite on a construction job—something to be used when nothing else will avail. Unlike the use of dynamite, however, a large-scale strike cannot be prevented from causing widespread damage. Public welfare is directly concerned in the way the strike power is used.

Charles O. Herb

EDITOR



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Separate Small-Parts Machine Shop Saves Money

By L. G. VINES
General Supervisor of Planning
El Segundo Division
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IMPORTANT economies have been effected by the El Segundo, Calif., Division of the Douglas Aircraft Co., Inc., by the setting up of a small-parts machine shop in an area that is isolated from the general machine shop. While many machined parts for airplanes are large and must be handled on big machine tools, from 30 to 40 per cent of these parts are within dimensions of 3/8 inch by 2 inches by 4 inches or within dimensions of 1-inch diameter by 6 inches in length.

Many such parts can be machined at a smaller sum than was formerly expended in writing out shop orders and keeping records. At that time no special provisions were made for machining the small but important parts, and consequently they were handled on any suitable machine that happened to be immediately available in the general machine shop.

Obviously it was not the best manufacturing practice, and Douglas did something about it a year ago. After conducting a survey which showed that a break from the larger production pieces could be made on the basis of sizes men-

Fig. 1. (Left) Performing a typical operation on one of several small profile milling machines.

Fig. 2. (Right) Two sensitive drilling machines that are used in the small-parts machine shop.

Fig. 3. (Below) Fourteen-inch band saw used for a large variety of cutting operations on many types of metals, laminated plastics, and other materials.

Fig. 4. Cabinet in which tools are stored on one side and raw materials on the other side.

tioned, the separate small-parts machine shop was established. This department affords unusually close coordination between the planning, designing, tool-fabrication, and part-fabrication departments. It relieves premium equipment in the general machine shop from most small jobs and eliminates a great deal of paper work.

The equipment in the small-parts machine shop is confined within a relatively small area. Machines are provided for turning, sawing, profiling, drilling, and smaller operations, and also for acid etching and applying iridite and chromate primers.

The heading illustration shows two 9-inch Hardinge engine lathes. The operator in the foreground is engaged in boring bolt holes in flanges. The machine in the background is being used for turning, boring, and cutting off bushings. In Fig. 1 is seen a Wade profile milling machine engaged in a standard operation. The movements of the tool around the work-piece are controlled by a stylus on the tool-head as the stylus is moved around a template of the work. There are three machines of this type in the department. In Fig. 2 are seen Delta and Walker-Turner drill presses which take work up to 7 inches between the drill spindle and the machine column. Work is sawed along straight lines or contours on the 14-inch Delta band saw illustrated in Fig. 3. However, there is also a Delta 10-inch table type saw for performing straight cutting operations.

In addition to the machines illustrated, the de-

Fig. 5. Variety of parts which are routed from sheet-metal stock and then slotted and drilled on pantograph engraving machines.

partment contains an Armglo horizontal belt sander, a Baldor 6-inch double-end pedestal tool-grinder, a James dishwasher for metal parts, several dip tanks for use in obtaining surface finishes, and an inspection bench. On one side of the department is the cabinet illustrated in Fig. 4 which is used for the storage of tools and raw stock.

Every full order for small parts is run through the department immediately. Parts in excess of present requirement are stored for delivery to assembly departments as needed. This practice is contrary to regular production procedure, under which only the number of parts specified in an order are run through the department. Consequently, while there is no hard and fast rule, lots of various small parts are as high as fifty pieces.

Adjacent to the small-parts machine shop is a "duplicating" area in which Gorton pantograph engraving machines are used as high-speed routers. Two operations are fairly general—routing the part from stock and cutting holes or slots. Fig. 5 shows a considerable variety of parts that are produced by these engraving machines. Standard end-mills up to 3/8 inch diameter or standard router-cutters are employed. Speeds range from 1300 to 9200 R.P.M., depending upon the material.

Two of the engraving machines in this department are illustrated in Figs. 6 and 7. The templates used on these machines are generally made twice the size of the part from flat metal sheets on which the work outline has been reproduced by photography and cut out on the engraving machines. In the engraving machine illustrated in Fig. 6, stock is held in an adjustable vise in the center of the machine table while the template is clamped on the copy table above the work spindle. On the machine seen in Fig. 7, the copy table is on the right-hand side.

Routing is accomplished without burring on such materials as aluminum alloys, stainless steel, chromium molybdenum, titanium, laminated plastics, and other materials. Methods formerly employed in producing these parts required as many as sixteen setups and twenty-six different operations. These jobs have all been reduced to no more than two operations, and up to 100 parts can be obtained per hour free of the burrs that were previously present on these parts. Micro Mist Metaloid coolant is employed to facilitate the routing operations.

Fig. 6. Small-size pantograph engraving machine employed for turning out work-pieces of the kind illustrated in Fig. 5.

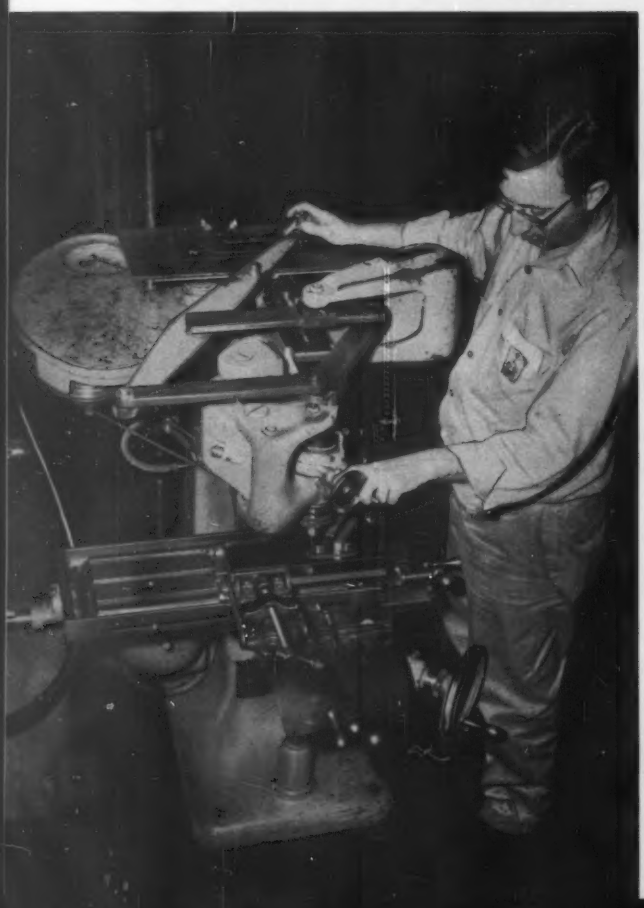
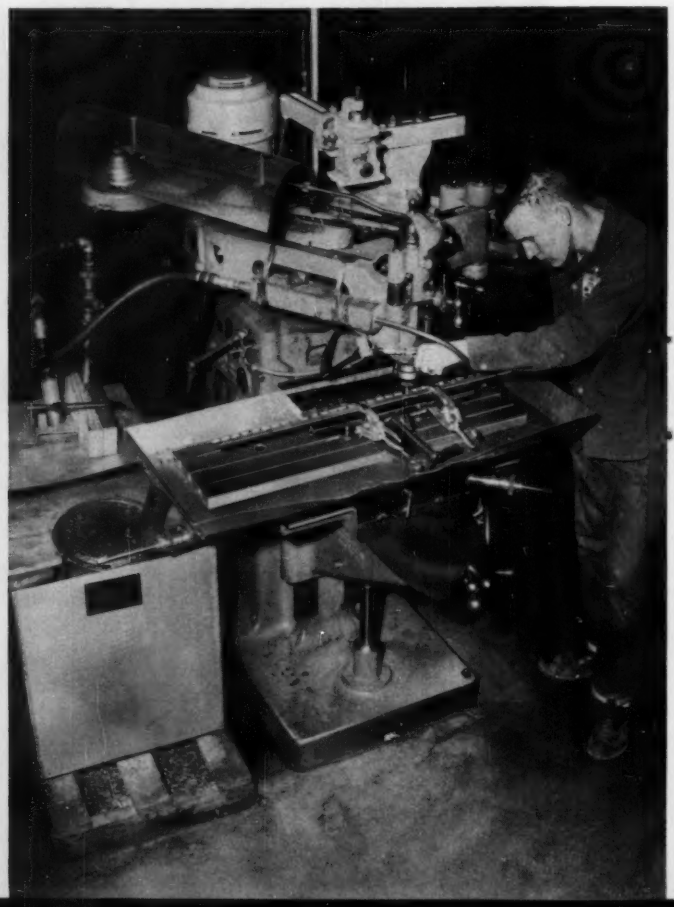
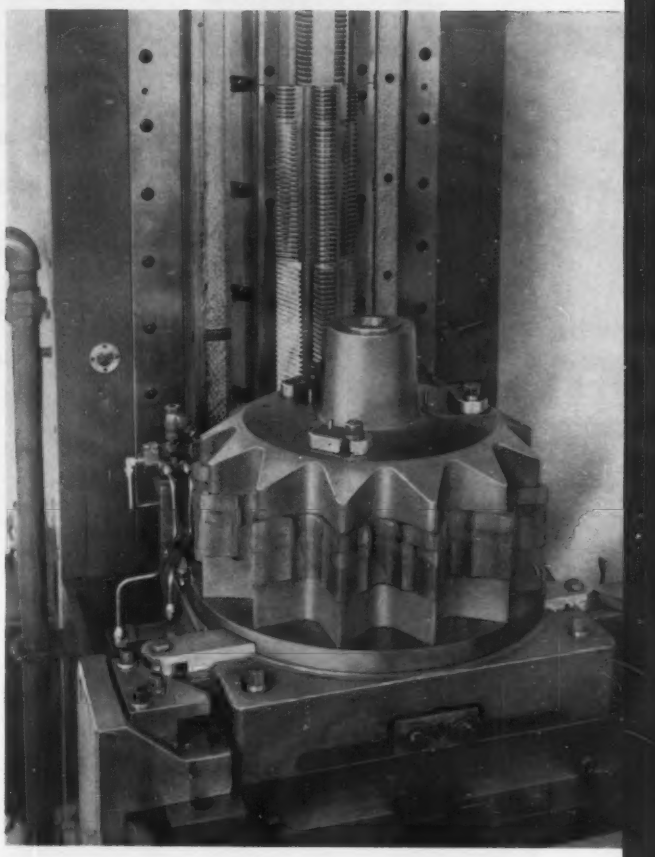


Fig. 7. Pantograph engraving machine of somewhat larger size that is also used for producing some of the parts shown in Fig. 5.



Accurate Surfaces Start with Good Broach Design



Broaching is a rapid and accurate metal-removing process resulting in a good quality finish. Although some fundamentals of broach design can be presented as being applicable in many instances, most tool design problems have to be resolved on an individual basis.

By HARRY GOTBERG
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WHILE it would be almost impossible to draw up a set of standard broach design rules to suit all broaching applications, there are certain basic principles that must be followed in the vast majority of cases. Beyond this point each job must be considered individually; the ultimate solution being based on the variables encountered and the experience of the broach designer in meeting them.

Some of the factors that must be considered when designing any broach or major broaching setup for a specific application can be itemized as follows:

1. Type and hardness of the material being broached.
2. Length of the contact surface to be broached and the amount of stock to be removed.
3. Limits and surface finish to which the broached hole or surface must be held.
4. Condition of the part before broaching—previous machining operations and the position of locating points.
5. Diameter of the hole or width of the surface.
6. Specifications of the machine to be used—type, power, and length of stroke.

In addition to these six governing factors there are many other points that strongly influence a particular broach design and that must be taken into consideration and treated as specialized problems. The broaches illustrated in Fig. 1 attest to the many special features that must be borne in mind by the designer.

Broach Strength and Chip-Carrying Capacity

The fundamental requirements of a broaching tool are adequate strength and chip-carrying capacity. Insufficient chip room will cause the chips to pack between the teeth and may result in failure of either the individual teeth or the entire broach. The optimum amount of chip space varies in accordance with the material being broached. It is important to note that the separation of a chip from the body of the work-piece by each individual cutting tooth of a broach is

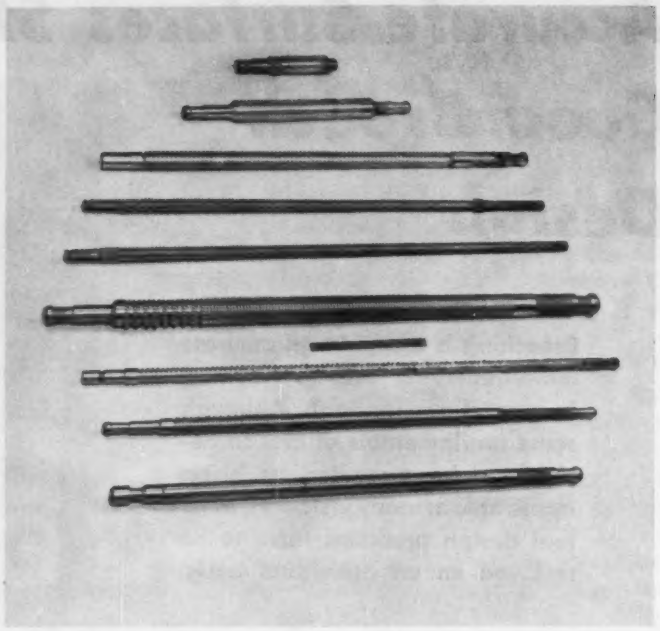


Fig. 1. Various types of internal broaches showing the differences in length, diameter, and configuration that must be resolved by designer.

Approximate Values for Broach-Tooth Design Factors Based on Length of Cut

Length of Cut, Inches	Pitch, Inches	Tooth Thickness, Inch	Tooth Depth, Inch	Radius, Inch
3/32	3/64	1/64	0.020	0.007
1/8	1/16	0.020	0.020	0.010
5/32	3/32	1/32	1/32	0.015
3/16	9/64	3/64	3/64	1/32
7/32	3/16	5/64	1/16	1/32
1/4	7/32	3/32	1/16	1/32
3/8	1/4	3/32	5/64	3/64
1/2	9/32	3/32	3/32	1/16
5/8	5/16	1/8	7/64	1/16
3/4 to 7/8	11/32	1/8	1/8	5/64
1	3/8	1/8	1/8	5/64
1 1/8	13/32	9/64	9/64	3/32
1 1/4 to 1 5/8	15/32	5/32	5/32	7/64
1 3/4 to 2	17/32	5/32	3/16	1/8
2 1/4 to 2 1/2	5/8	13/64	7/32	9/64
2 3/4 to 3 1/4	11/16	7/32	15/64	15/32
3 1/2 to 4	3/4	7/32	9/32	3/16
4 1/4 to 4 3/4	13/16	7/32	19/64	3/16
5 to 5 1/2	7/8	7/32	5/16	13/64
5 3/4 to 6	15/16	1/4	11/32	7/32
6 1/2 to 7	1	1/4	23/64	7/32
7 1/2 to 8	1 1/16	9/32	3/8	1/4
8 1/2 to 10 1/2	1 3/16	5/16	25/64	1/4
11 to 12	1 5/16	11/32	13/32	17/64

not unlike that resulting from the action of virtually any other single-point tool. However, the disposal of that chip after its separation is quite different in broaching than it is in other metal-cutting operations.

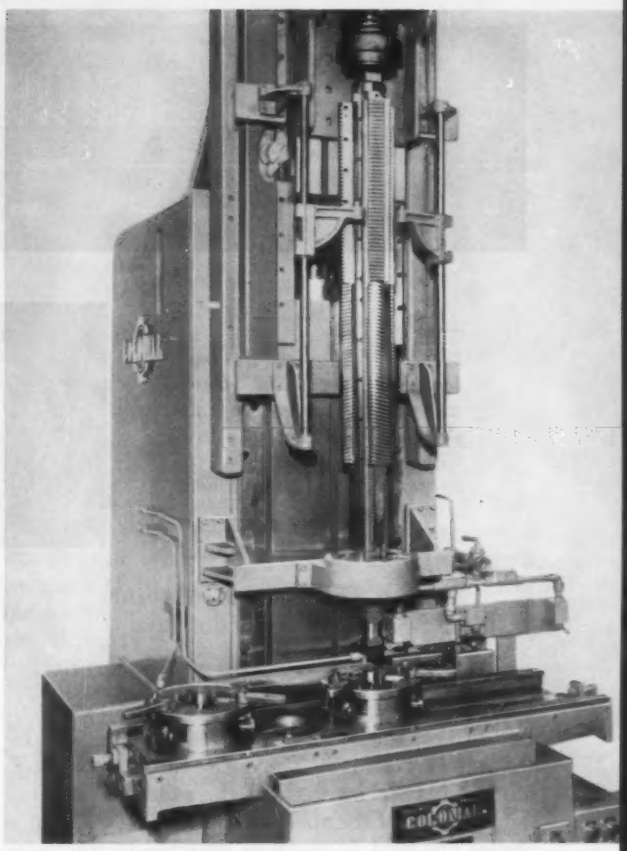
Chips from single-point tools are disposed of almost as quickly as they are formed, whereas chips from broach tools must be carried in the chip space between the teeth throughout the entire length of the cut. Therefore, when designing a broach, it is important that the chip-carrying function of the tool always be given careful thought.

From the user's standpoint, one of the most important broach design considerations is adequate strength for the particular application. In computing adequate strength requirements, specific machine types or sizes must be considered. Allowable machine pull for the broach should be known and not exceeded in practice. An insert type internal broach is being used on the pull-down machine in Fig. 2.

Tooth Spacing is an Important Factor

Tooth spacing, or pitch, (as shown in Fig. 3) has an important bearing on the length of cut and on the chip thickness that the broach will handle. It also determines the number of teeth that will be in contact with the work at one time. Usually, a smaller pitch is permissible when machining cast iron than when machining steel,

Fig. 2. Broaching setup in which an insert style internal broach is mounted on a pull-down type machine.



since less chip room is required. Although selection of the tooth pitch should be based on experience, approximate values that can serve as guides are listed in the accompanying table.

Care should be taken that at least two teeth, but preferably three or more, are in contact with the work during the cut. If the machine capacity is inadequate to handle this, the best practice is to reduce the step per tooth rather than reduce the number of teeth in contact with the work by increasing the pitch.

Vibrations during general broaching or the presence of annular marks in hole broaching are sometimes traceable to a variation in the number of teeth in contact with the work at any one time. This is caused by a change in resistance as one tooth leaves the work before or after another tooth has entered. Variable spacing of the teeth greatly reduces this type of vibration. Difficulties from this source are less frequently encountered in surface broaching except when the broach is cutting either several surfaces on one part or several parts at one time.

When machining several surfaces at one time, it is usually desirable to avoid having the teeth for different surfaces engage the work simultaneously. Broach inserts should be so mounted as to stagger the engagement.

Hook Angle Varies with the Work Material

The hook, or face, angle of a broach tooth varies with the material to be cut. Ductility, hardness, and toughness of the work material also determine the variation in the step per tooth. The angle, in general, increases with increasing ductility but decreases with increasing hardness. Smaller face angles are more effective on brittle metals such as cast iron and brass.

Approximate face angles that normally can be used when broaching typical materials are as follows:

Cast iron	6 to 8 degrees
Hard steel	8 to 12 degrees
Mild steel	15 to 20 degrees
Aluminum	10 degrees and over
Brittle brass	−5 to +5 degrees

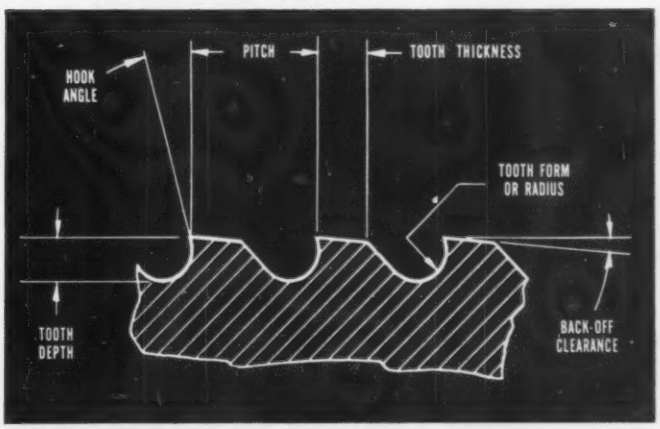


Fig. 3. Cross-section of typical broach teeth that includes the nomenclature commonly employed in their design.

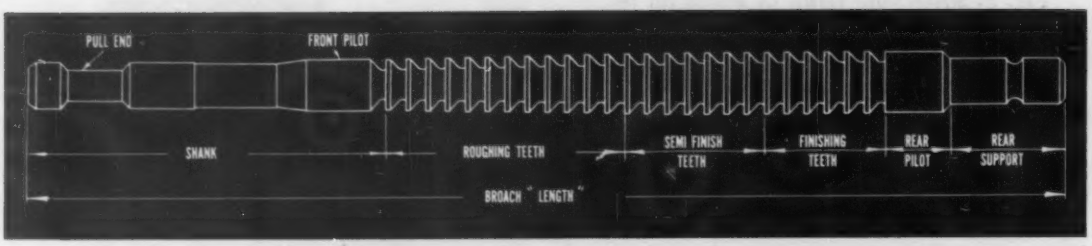


Fig. 4 (Above) Over-all broach length is determined by length of its several functional sections. Terms applied to these sections are shown.

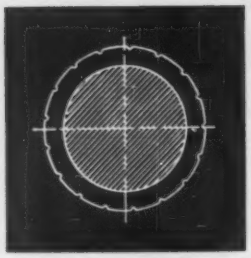


Fig. 5. (Left) The chip-breakers are seen spaced around the periphery of a broach tooth. The location of the notches is staggered on successive teeth.

Tooth Thickness Determines Strength and Tool Life

The thickness of a broach tooth, Fig. 3, has a direct bearing not only on its structural strength but also on the number of times the tool can be sharpened. Normally, the entire thickness of each tooth is backed off slightly, the exact angle being determined for the specific application. Clearance angles are held as small as possible to minimize loss of size when the broach is resharpened. Angles used on the roughing teeth are sometimes larger than the angles used on the finishing teeth.

For some applications the lands of the finishing teeth are not fully relieved. This unrelieved portion is often graduated in length from the first finishing tooth to the last sizing tooth to give maximum broach life. The length of this portion must be carefully controlled when making the broach because too much unrelieved land increases friction and heat during the cutting operation. As a result, expansion and galling of the tool might occur.

Depth of Cut per Tooth and Factors Determining Broach Length

Too great a step between adjacent broach teeth will overload each individual tooth and can result in tool failure. On the other hand, too light a cut with some materials will interfere with the cutting action and will increase the possibility of brazing, galling, and tearing of the broached surfaces.

A step of 0.0005 inch on the tool diameter for free-cutting materials is the practical minimum established through many years of broaching experience. The step per tooth for roughing cuts may range from 0.0015 inch on a round-hole broach to 0.006 inch on surface broaches when machining free-cutting steels. Steps between semifinishing teeth are reduced to improve the finish of the work. These figures will vary appreciably with different materials, broach sizes, and machine capacities.

Three major factors determine the length of a broach: amount of stock to be removed, length of cut, and allowable chip thickness. Length of cut and types of work-piece materials usually determine tooth spacing. The allowable step per tooth regulates the total number of teeth. The number of teeth required multiplied by the tooth spacing will fix the length of the cutting portion of a broach. Over-all broach length is determined by adding to the length of the cutting portion the pull-shank length and the rear pilot length. The nomenclature of a typically designed broach can be seen in the diagram in Fig. 4.

Chip Breakers and Broach-Tooth Design

Round internal broaches tend to form continuous chip rings that quickly clog the tooth gullet. This is prevented by the use of notches, or chip breakers, which are staggered from tooth to tooth around the periphery of the tool, as illustrated in Fig. 5. Surface broaches also make use of chip breakers. Narrow chips are more easily eliminated from the teeth than are the wide chips normally formed by a surface broach and which tend to jam the tool. A shear-cutting design in which the teeth of the broach are set at an angle to its direction of travel, usually 5 to 20 degrees, is used frequently for surface broaching tools. With this design each tooth is eased into the cut, the cutting load increasing with the

forward travel of the tool until the entire tooth is working. The major advantages of such a tooth type are smoother cutting action, minimum vibration, and improved surface finish.

However numerous its advantages, a shear-cutting tooth does have one limitation when used on a surface broach. If the broach has to cut the entire width of a relatively deep slot, the chips will be forced against one side of the slot and may produce a rough surface or cause a tearing condition in the corner. Experience is, however, still the best teacher in designing broaches that will give satisfactory, trouble-free performance. Even the jobs that appear to be similar, at first glance, may present difficulties that are not apparent to the designer with limited experience.

Welding Fixture Features Rotating Table

AUTOMATIC submerged-arc welding plays a key role in fabricating radiator drums at the Rybolt Heater Co., Ashland, Ohio. Walls of the drums are hollow, consisting of two cylindrical shells, one within the other. A flanged ring is welded to each end of the shells, creating an airtight jacket through which products of combustion are circulated.

After the shells are rolled to form, seams are arc-welded manually. A ring is tack-welded to hold the shells in position, then the assembly is positioned in a C. C. Peck "Little George" fixture mounting a Lincoln Electric submerged-arc automatic head. Rings are welded by the head, which is supported on the end of a horizontal boom. The work rests on a rotary table, being clamped externally by a copper yoke and internally by an expanding shoe.

As the table rotates, the flanged ring moves directly beneath the head, through which a wire electrode is fed. Just before welding starts, flux flows down to cover the arc, continuing until the weld is completed. As soon as the arc is struck, the table starts to rotate and proceeds at a rate of 70 to 80 inches per minute. The table drive can be seen in the left-hand foreground of the illustration.

During welding, the operator uses a suction hose to pick up unfused flux and return it to a high-level hopper. The ring is first welded to the outer shell, then the inner shell. Rotational speed is adjusted so that welding speed is approximately the same for each shell. After fused flux has been knocked off, the drum is inverted and the second ring welded in an identical manner. Production is at the rate of nine to ten drums per hour.

To weld the ring to the radiator drum, the table of the fixture rotates the work beneath the automatic head. Inner and outer welds are performed in sequence.

By WAYNE H. ULMAN
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Lathe Operations Directed by Numerical Sequence Programmer

AN increasing number of lathes are being utilized for the production of comparatively small quantities of a variety of parts. In an effort to maintain inventories of these parts at an absolute minimum, the machine setup for each particular item usually must be repeated frequently. When a small number of parts are involved, setup time becomes a substantial portion of the total machining time.

With this type of operation in mind, the Monarch Machine Tool Co., Sidney, Ohio, has developed a numerical sequence programmer that is capable of directing the performance of a lathe while taking multiple cuts. The unit incorporates an easily changed operating cycle and also a memory system that permits quick repetition of any particular setup. Although the programming unit shown in the heading illustration is being used with one of the company's 10-inch Series EE lathes, it can also be applied to larger machines. The unit, which is housed in an individual cabinet enclosure, allows fully automatic machining cycles of from one to five passes to be made across the work-piece, the setup being easily accomplished by means of a series of push-buttons. This limit of five passes is not a restriction of the programmer, but a restriction of the lathe being used which has three electrically actuated cross-slide stops and one rough and one finish tracing template. Thus, only five different cutting depths are available, none of which can be re-used during a particular machining cycle.

The illustrated lathe is equipped with a standard headstock, tailstock, and carriage. Contours are produced by a built-in angular air-gage tracer slide that is mounted on the cross-slide of the carriage. Grid-controlled thyratron rectifiers furnish power to the direct-current feed motors and to the spindle motor. Infinitely variable spindle speeds ranging from 40 to 4000 R.P.M. and feed rates ranging from 1/2 to 20 inches per minute are adjustable by potentiometer controls.

A punched card is used with the programmer and reduces setup time to a minimum. The card is prepared directly from the blueprint and provides data storage for setting up repeat runs of any part. By utilizing a decimal data input system for controlling the various positions of the car-

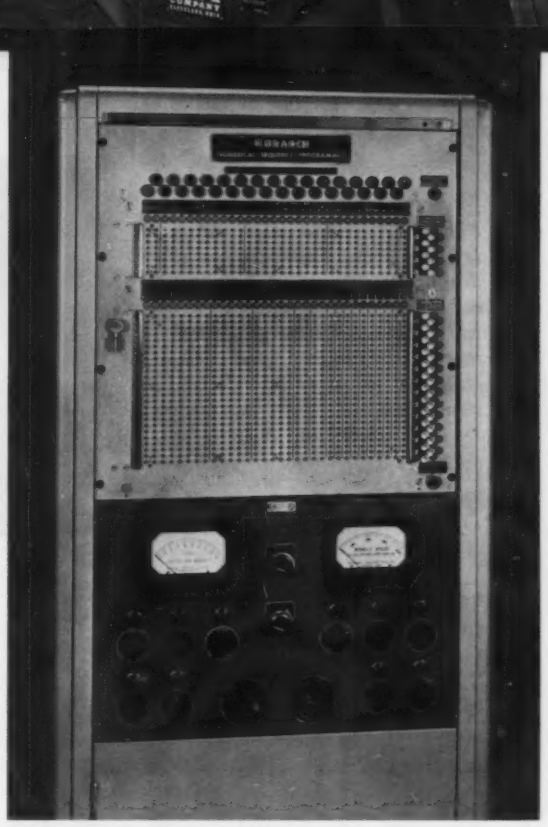


Fig. 1. Keyboard of numerical programmer provides push-button selection of the machining sequence as well as the numerical selection of carriage and cross-slide positions. Carriage position register (length of cut) is at top, with the cycle sequence register immediately below.

riage at which an alteration in the operation is to take place, no special coding charts are required for card preparation. Space is provided on the card for writing in the number and description of the part as well as other pertinent information. Data for setting various feed rates and spindle speeds also are recorded.

In place of punched programming cards, transparent Lucite panels that have been drilled to coincide with the rows of push-buttons are shown. Removable pegs are inserted in the proper holes so that the desired pattern of buttons will be depressed when the plates are placed in contact with the keyboards.

Five variable adjustments are provided for the spindle speed and five for the feed rate. As a result, incremental changes can be made easily to compensate for differences between individual tools, giving good chip action and long tool life.

The heart of the machine control unit is the programming keyboard shown in Fig. 1. It makes possible push-button selection of the machining sequence as well as numerical selection of the carriage positions. The keyboard may be set either manually or by placing the punched card over the face of the unit and depressing the exposed buttons.

A carriage position register extends across the upper portion of the keyboard. The travel limits imposed upon the lathe carriage by the entries into this section are not necessarily end positions of the pass. They can be, and frequently are, signal points that cause a change of feed or spindle speed to take place as the carriage continues to feed to the left during the cut. Selection of these limits is accomplished by depressing buttons corresponding to the desired digital position of the carriage at the end of each phase of the operation as measured from a reference point such as the right-hand face of the work-piece. An analog-to-digital converter supplies carriage-position information which is compared with the keyboard information to signal the carriage travel limits.

Below this part of the keyboard is the cycle sequence register composed of many rows of push-buttons. The buttons that are depressed in each row determine the operating characteristics of the machine during the individual cuts since each row corresponds to an element of the cycle.

The method of preparing the keyboard for a machining operation can be illustrated by referring to the typical work-piece seen in Fig. 2. In this instance the first three cuts taken are straight passes and are intended to remove a large percentage of the unnecessary material. A rough template cut is made during the fourth feed movement of the lathe carriage, followed by a finish template cut during the fifth and final pass across the work.

From the illustration it can be seen that the first cut extends a distance of 3.44 inches from the right-hand end of the part, which is considered as the zero point. Thus, in Row 1 of the carriage register (upper portion of the keyboard) the appropriate buttons are depressed to indicate the desired end position of 3.44 inches. Similarly, buttons in Rows 2, 3, and 4 are depressed to indicate 1.53, 1.31, and 5.10 inches, which are the respective desired end positions of the second, third, and two template-controlled cuts. It should be noted from the drawing of the exemplary work-piece that all control-position settings are used to terminate a pass, and none are earmarked to merely alter the feed rate or spindle speed while still feeding to the left.

In the cycle sequence register (lower portion of the keyboard) the end limit for the first cut is established by depressing the control-position button corresponding to the first row of the carriage register. The feed-rate and spindle-speed buttons corresponding to the individual pre-set potentiometers on the face of the control panel (below the lower keyboard) also are depressed.

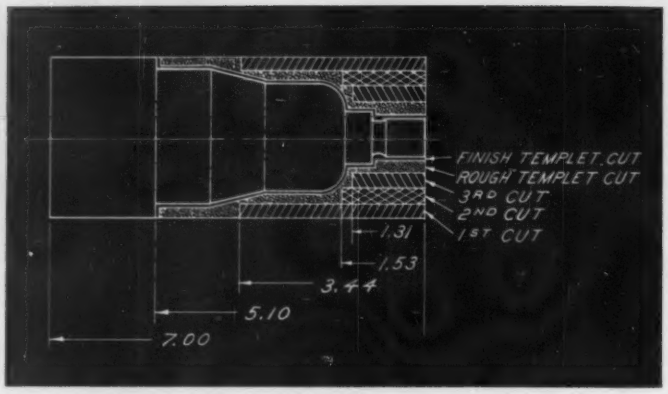


Fig. 2. Typical work-piece that is rough- and finish-turned under the guidance of a numerical sequence programming unit. Five separate passes are made. Three of these are straight cuts, followed by a rough and a finish template-controlled cut.

Forward rotation of the spindle, functioning of the tracing head, and operation of the coolant pump are determined by other buttons in the first row. These selected conditions remain in effect until the carriage reaches the end position indicated for the first cut.

When the cutting tool reaches the limit of the first pass, a signal light is illuminated, and the second horizontal row of push-buttons in the cycle sequence register automatically becomes effective. For the second cut it is desirable that the carriage return to its starting position. This action is controlled by the traverse-right button.

The second and third cuts are performed in the same way with the carriage moving in the feed direction until the corresponding control positions have been reached. Rough and finish template cuts function similarly, except that the cross-slide is permitted to move in until it is directly controlled by the respective templates. For the final pass the finish template is brought into action by depressing the finish-cut button in the row of the cycle sequence register that corresponds to the last cut. The traverse-right button in the row directly below that controlling the concluding cut is used to return the carriage to its starting position, and the reload button is used to signal the end of the cycle.

Automatic machine operation is initiated by means of the start-cycle button shown at the operator's control station in Fig. 3. The resulting signal is fed into a register selector circuit which, in turn, indexes the cycle sequence register from the reload position to the position necessary to repeat the first operation. Signals sent from the cycle sequence register select the proper length

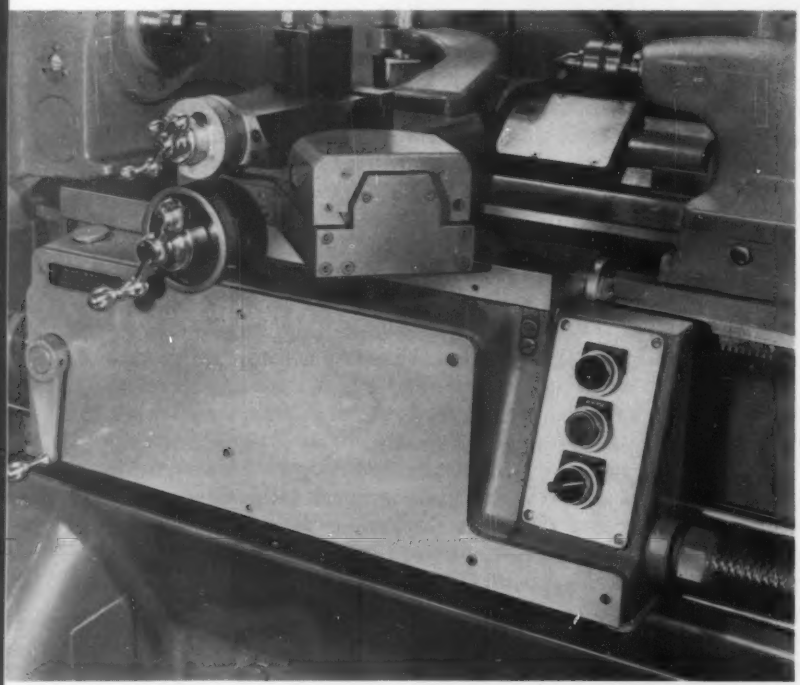


Fig. 3. Machining cycle is initiated by depressing the start-cycle button at the operator's control station on the lathe carriage. Included in this group are an emergency reverse button (center) and a conventional on-off switch (bottom).

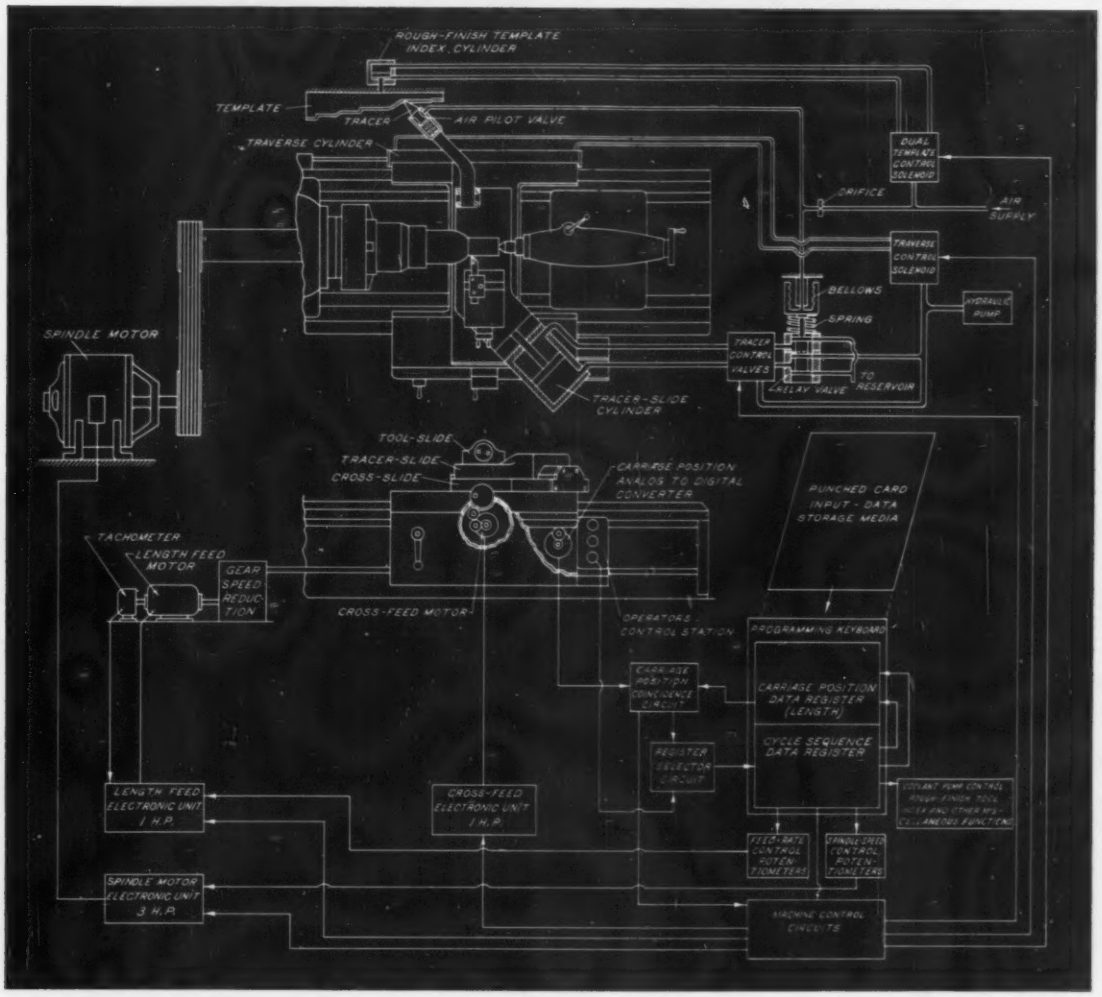
of cut along with the feed rate, spindle speed, coolant on-off, and other functions as dictated by the buttons depressed during setup. Although the depth of cut is controlled by electrically actuated cross-slide stops, it also may be controlled by a separate data register and digital converter.

In the diagram in Fig. 4 can be seen the interrelationship of the electrical components of the numerical sequence programmer with the operating components of the machine tool. When the carriage reaches the commanded end position, a coincidence signal is fed into the register selector circuit to index the cycle sequence register to the next operation. The second operation may be either a continued cut with new feed rates and spindle speeds or a traverse motion of the carriage to the right. If a traverse return is programmed, the tool is automatically relieved from the work-piece, following which the cross-slide can be set for the new diameter to be turned.

Maintenance of the entire programmer unit has been simplified by the use of lights to indicate the performance of each of the machine functions and control components that are divided into groups of closely interrelated parts. Each component group is mounted on a separate, removable chassis that is designed to utilize the latest concepts of plug-in construction.

Operation of indexing tool-turrets and auxiliary tool-slides and the maintenance of constant surface speeds for maximum tool efficiency and tool life may be programmed into the work cycle. The programmer also facilitates use of the machine for producing large quantities of parts since the unit, once set up, provides remote controlled machining of as many duplicate pieces as desired.

Fig. 4. Block diagram of numerical sequence programmer showing interrelationship of all its electrical units with operating components of tracer-equipped lathe. An analog-to-digital converter is built into machine carriage to control longitudinal movement.



Quality Control of Powdered Metal Parts

By GEORGE L. BACHNER, General Manager
Powdered Metal Products Division
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Franklin Park, Ill.

PRODUCTS made by compacting and sintering metal powders involve so many variables that ordinary purchaser specifications are likely to be meaningless. For this reason, it is advisable for purchasers to indicate what the product must do in service, rather than specify detailed chemical composition, or properties such as density, strength, or hardness. Experienced suppliers understand this well and, like the Yale & Towne Powdered Metal Products Division, take extreme precautions to control the variables so that the end product will be uniform and dependable.

In addition, breaking, crushing, impact, and other tests—some simulating severe conditions of use—are performed at frequent intervals. Operations are closely controlled. In sintering, for example, automatic controls for temperature and for furnace-atmosphere composition are employed regularly.

All new jobs at Yale & Towne are carefully analyzed, and temporary specifications are drawn on processing. Often, experiments are required to attain given ends. Generally, samples are supplied to customers for actual or simulated service testing. But once the conditions necessary to maintain product uniformity are determined, the fabricator's final specifications for minimum values and correct processing are drawn and followed rigidly.

In production, quality control starts with selecting and preparing the powder mixture. Each ingredient is sifted and weighed. This is done to a definite specification, and each batch is numbered for reference in later checks. Mixing barrels are heated electrically to assure proper distribution of lubricant through the powder. Batches are supplied as needed to the compacting presses.

Fig. 1. Various standard and special gages and fixtures are used to check powdered metal parts.

Each press is carefully set to apply the required pressure as determined by the die design, and the dies are filled with a specific volume of the powder. Regular checks are made at the presses on weight and critical dimensions.

Compacts are stacked on trays and transferred to continuous type electric sintering furnaces, in keeping with the manufacturing schedule. These furnaces can hold temperature to plus or minus 5 degrees F., and are provided with flow meters and other equipment to supply a protective atmosphere at predetermined rates and amounts. Graphical records of furnace temperatures are made and coordinated with loading information so as to meet subsequent tests.

After cooling, the sintered parts are inspected for size, using equipment such as seen in Fig. 1. A second inspection is made on those parts which later are coined. Much stress is placed on breakage tests that are applied to a specified percentage of each batch. Such tests are considered the best indication of the serviceability of the parts in that batch. Should a test part fail to meet requirements, the entire batch is rejected. Frequently, the test applies loading of the same nature as that encountered in service, but of

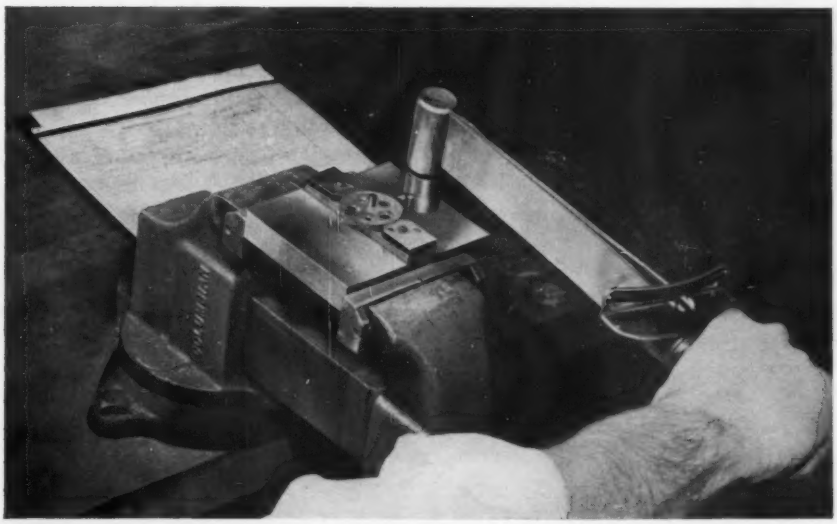


Fig. 2. A torque wrench checks the strength of the teeth of a sintered gear. The fixture prevents the gear from turning.

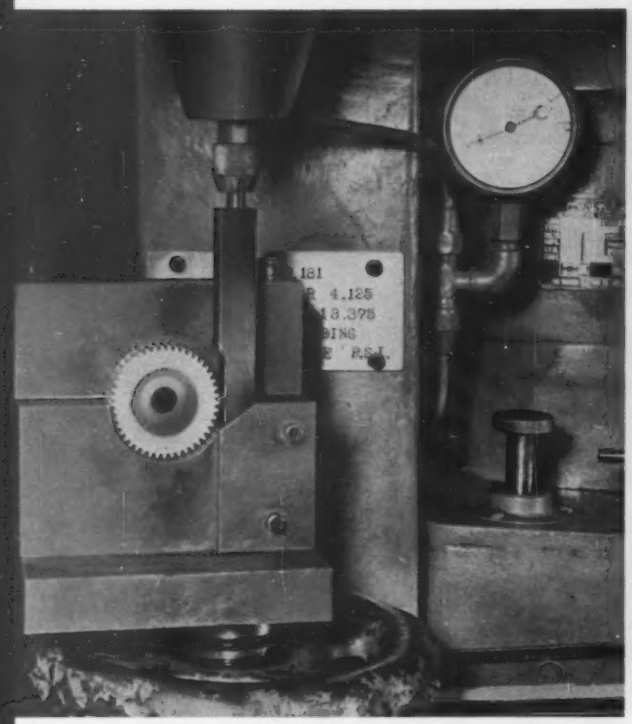


Fig. 3. The fixture holds the gear hub, while a "punch" having a single tooth is forced downward by hydraulic pressure.

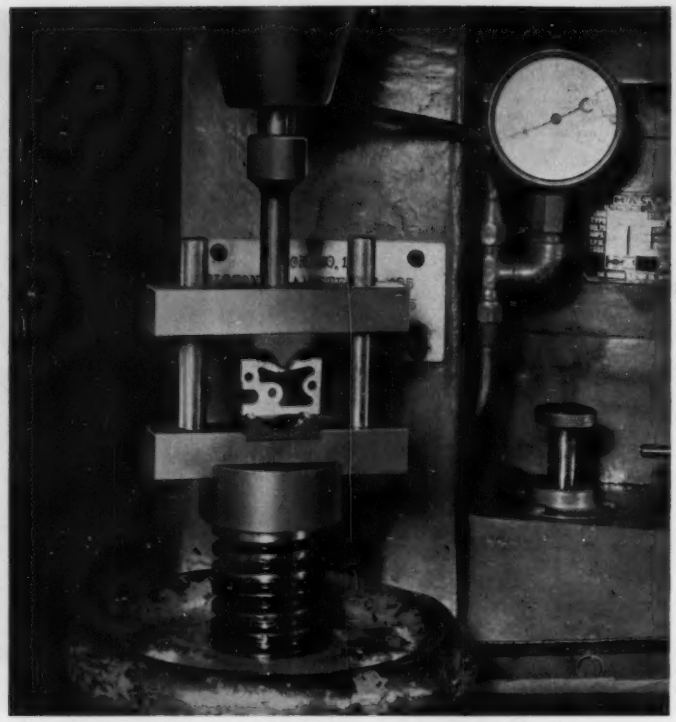


Fig. 4. By means of this special fixture, bending stress is applied to the center of a hollow, rectangular part.

greater intensity, so that ultimate strength can be determined by actual breaking.

Parts such as gears are loaded in torsion, as this is the nature of their load in service. Since the test is made on a single tooth of the gear, it is also a measure of the crushing, shearing, or bending strength of the tooth. This test is also applicable to elements like keyways or splines.

One simple method involves a torque wrench, as in Fig. 2. The gear is locked against turning around a pivot pin, and the wrench socket has a single hardened tooth engaging one of the gear teeth. Torque is measured on the calibrated scale of the wrench.

A similar test, but with pressure applied hydraulically, is made on a Tinius Olsen machine, shown in Fig. 3. Here, the hub of the gear is supported between yokes, with a fixture pin intersecting two teeth to resist the torque of a single-tooth "punch" at a diametrically opposite point. Breaking pressure is indicated by a gage. This test is particularly useful for gears too large for the torque wrench setup.

Crushing tests for some circular parts are also performed on this machine. A small flywheel is seen under test in the heading illustration. Although the load is radially inward and the reverse of the centrifugal force encountered in service, it gives a suitable index of strength.

For testing a hollow, rectangular part, Fig. 4,

Fig. 5. A part is shown before and after an ear at one end has been crushed with a pair of pliers in a test of its ductility.

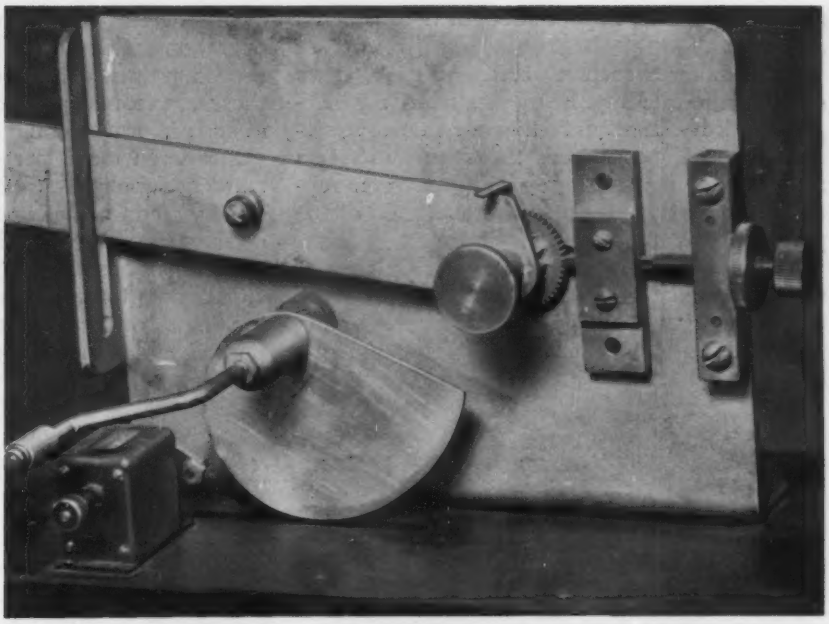


Fig. 6. A small powdered metal gear is subjected to an impact test of tooth strength while held in this manually operated fixture.

the work is supported in a special fixture. The work rests on an anvil having contact at two points, one near each end, with the punch located centrally. The stress produces bending, and in this instance, localized crushing below the edge of the punch, as can be seen in the illustration. Again, the test involves a type of fracture unlikely to be encountered in service, even by overloading, but still serves as a useful index of the strength of the part.

Ductility requirements may be tested by crushing a part with a pair of pliers to a fixed stop. The two views of the part in Fig. 5 show how an ear at one end was distorted in this manner. Any sign of fracture signifies a condition of insufficient ductility.

On some gears, teeth are checked against fracture by repeated blows with a free-falling weight through a given distance, as in Fig. 6. If the struck tooth does not fracture after a specified

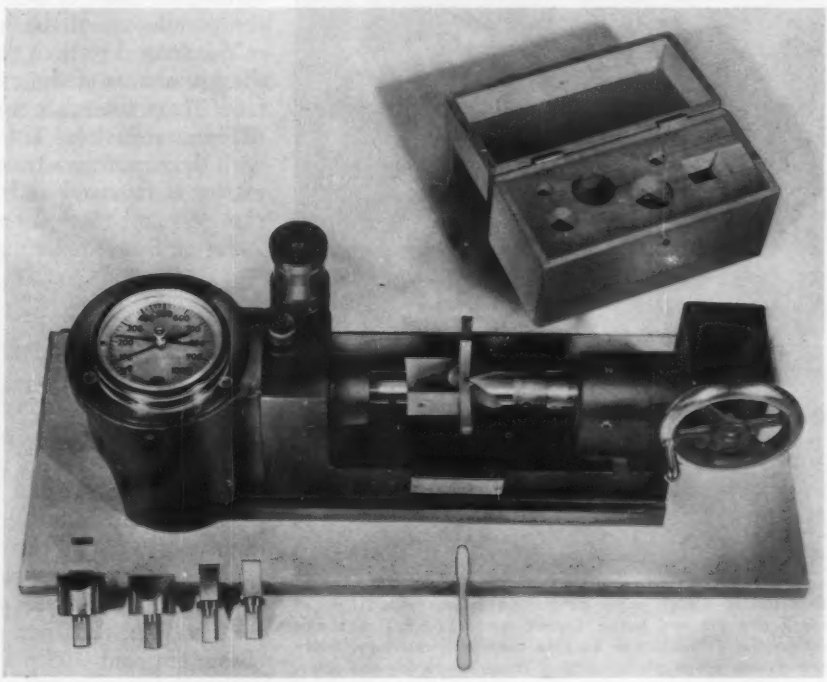


Fig. 7. This small testing machine aids in inspecting the strength and ductility of incoming powdered metal parts.

number of blows, impact strength is considered adequate.

The Haller bench machine, Fig. 7, tests strength and ductility. Being comparatively inexpensive, it has merit in setting acceptance standards right in the customer's plant. The illustration shows the equipment in use on a transverse rupture strength test of a standard specimen of the powdered metal material.

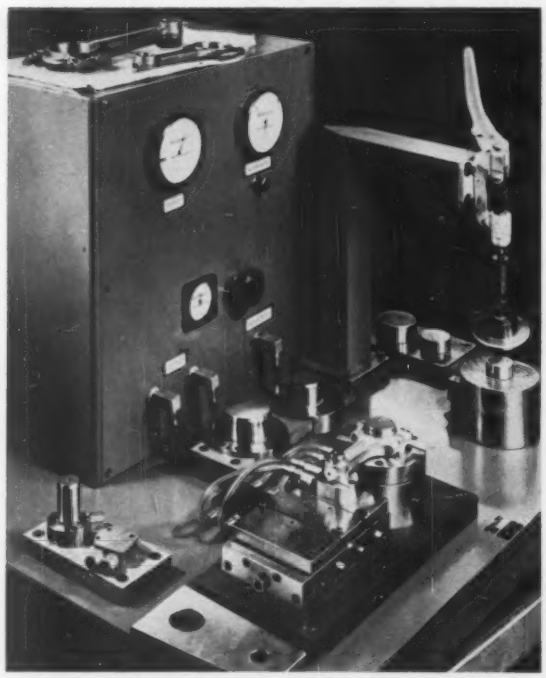
Parts are frequently coined after they are sintered, to hold closer dimensions or to increase density and improve physical properties. Coining presses on large-volume lots are generally fully automatic. As quantities decrease, semi-automatic operation and hand feeds are resorted to. If improved properties are required, tests similar to those of uncoined parts often are made as indices of such improvement.

Powdered metal parts designed for ordnance and other applications demanding extremely high quality are inspected under a system of statistical quality control which holds critical properties and dimensions to unusually narrow limits. Such checks help to predict any tendencies to exceed the limits, so that corrections can be made before unacceptable parts are produced.

Air Gage Checks Different Size Connecting-Rods

Flexibility and simplicity of design are features of a two-station air gage used by the Carrier Corporation for checking three sizes of connecting-rods. The gage, made by Federal Products Corporation, measures the parallelism of crank and pin end bores, as well as the squareness of the connecting-rod face to the crank end bore.

The first station, shown at left in the accompanying illustration, is equipped with two sets of interchangeable air plugs. One set is for measuring three sizes of crank end bores, and the second, for the corresponding pin end bores. Crank bore plugs are interchangeable at the fixed, right-hand position of the first station. Plugs for the pin end bore are mounted on a spring-loaded slide with three mounting positions, one for each connecting-rod.



First station (left) gages connecting-rod for parallelism of crank and pin end bores. Second station (right) measures squareness of crank end bore to connecting-rod face. Interchangeable plugs permit gaging three connecting-rod sizes.

With the proper air plugs in position, the gage is set with the master corresponding to the connecting-rod to be measured. The center distance between plugs is adjusted until the master can slide freely on and off the plugs. With the master held firmly in place, an air-gage reading is taken. The master is then flipped over, and a second reading is taken. Zero position is set at the middle of these two readings. By placing the connecting-rod to be gaged over the plugs, the parallelism of the holes is quickly checked.

The second station, shown at the right, checks the squareness of the crank end bore to the rod face. Three interchangeable air plugs handle the different rod sizes. The gage is first set to zero with the correct master clamped on the plug. The master is removed and the work-piece similarly clamped and rotated on the plug to show total variation from squareness.

* * *

Alloy for Nuclear Reactors

Scientists in Westinghouse Electric Corporation's atomic power division have developed a zirconium alloy that is resistant to the extremely corrosive action of high-temperature, high-pressure water in nuclear reactors. This is borne out by the fact that the corrosion rate of the alloy is only 0.010 inch per year when used in this type of service. "Zircaloy-2," as it is called, contains 1.5 per cent tin, 0.12 per cent iron, 0.10 per cent chromium, and 0.05 per cent nickel.

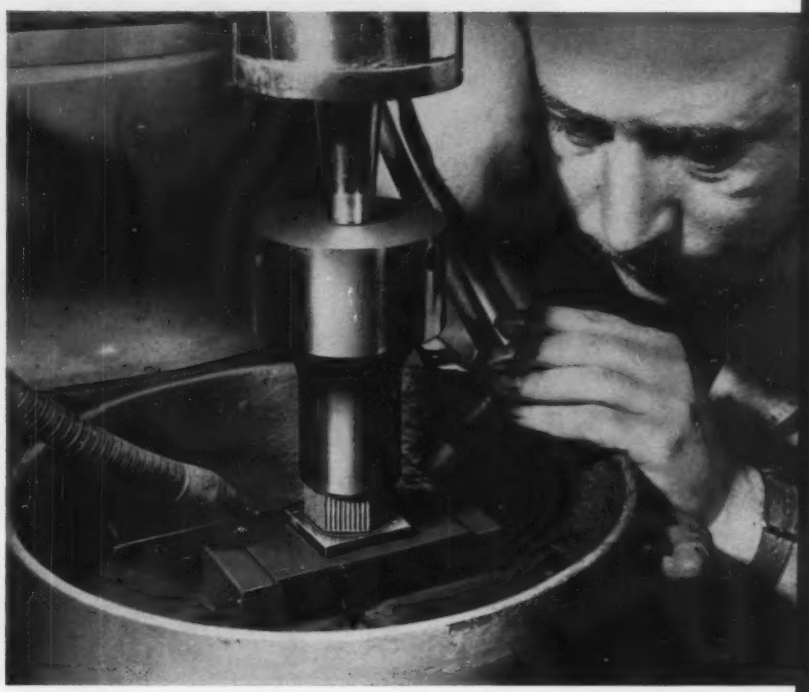
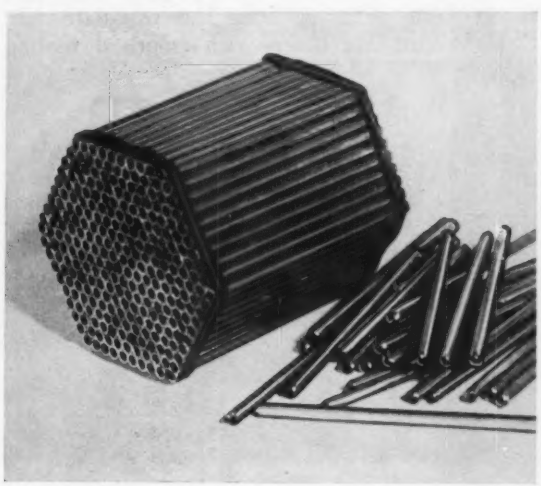


Fig. 1. (Right) A Sheffield-Cavitron ultrasonic machine is being used to dice germanium. Abrasive particles, activated by the rapidly vibrating tool, remove microscopic chips from the work-piece.

Fig. 2. (Below) Honeycomb pattern obtained by brazing 271 stainless-steel tubes into a hexagonal shape. This assembly is cut in half to provide two tools for use on machine seen in Fig. 1.

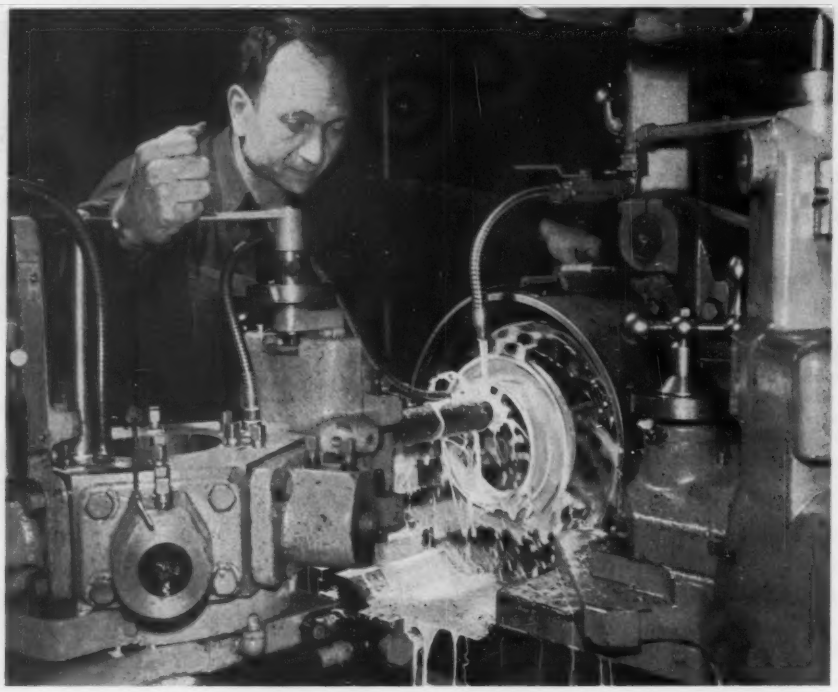
Stainless-Steel Tubing Used for Ultrasonic Machining Tools

STAINLESS-STEEL tubes are used in the construction of tools for ultrasonic machines by the Cavitron Equipment Corporation, Long Island City, N. Y. This has eliminated warping due to brazing during tool production and has also resulted in longer tool life. The ultrasonic machining method employs a high-frequency alternating electrical current to vibrate a tool of the shape of the orifice desired 20,000 times a second. Water-suspended abrasive particles, activated by the vibrating tool, remove microscopic chips from the work-piece. A Sheffield-Cavitron ultrasonic machine is shown in Fig. 1 using a tool made up of silver-brazed stainless-steel tubes. The assembly seen in Fig. 2 is cut in half crosswise to obtain two tools each 7/8 inch long.



The tool in this application is being used to dice germanium in the mass production of transistors. Tolerances of 0.0005 inch or less are required in assembling the tool components. Previously, carbon-steel tubes were employed but frequent warpage at brazing temperatures made their use impractical. Substitution of 19-gage stainless-steel tubing, made by Superior Tube Co., Norristown, Pa., served to eliminate warpage and increase tool life. The construction of the tool requires 271 tubes, each 2 inches in length.

The increased tool life is an important factor because of the time involved in making the assembly. The ability of stainless-steel tubing to hold a sharp, clean edge also contributes to the quality of the work.



Turret Lathe Tracing Pays Off in Job Shop

SUCCESSFUL job shops might well be called "tough job" shops. They have the reputation for handling the tough jobs along with the not-so-tough ones. For many of these shops, bread and butter comes from subcontracting. This extremely competitive field requires highly versatile labor and equipment—men and machines able to handle the various jobs that come their way.

A case in point is the machining of a jet-engine "doughnut" at the National Products Co., Cleveland, Ohio. The part—for a diaphragm housing—is an alloy steel forging approximately 9 inches in diameter. All surfaces require finishing to close tolerances. In Fig. 1, the work is shown as forged, left, and as machined, right.

A Jones & Lamson tracer-equipped ram type turret lathe, Fig. 2, does the complete job. Straight cuts are taken with standard tooling

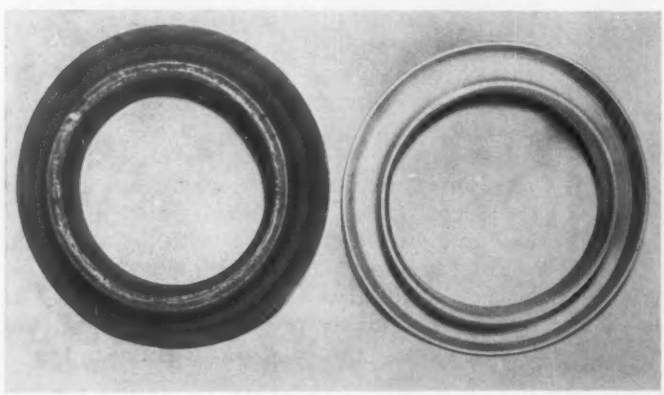


Fig. 1. All surfaces of the jet-engine "doughnut," including radii and tapers, are machined on a tracer-equipped ram type turret lathe.

Fig. 2. The tracer, mounted on the rear of the cross-slide, does not interfere with the tooling of the square and hexagon turrets.

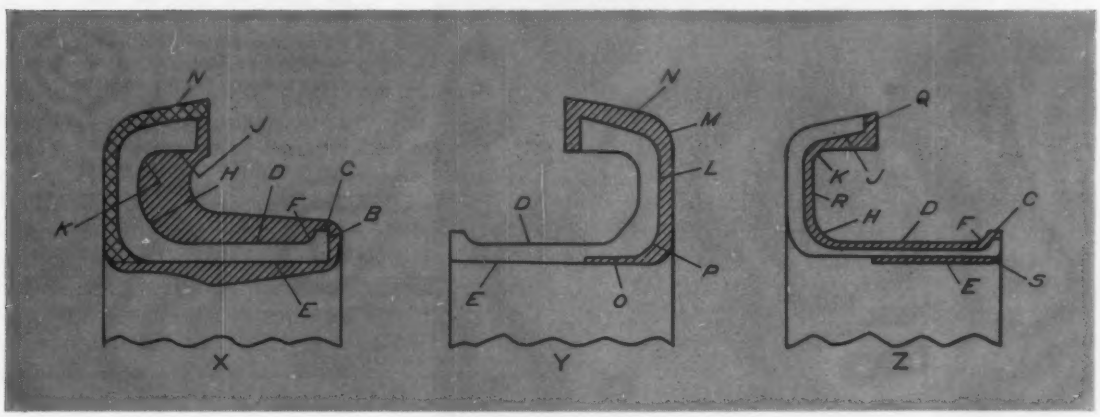
from the hexagon and square turrets; and contours and tapers are produced with the tracing head, mounted on the rear of the cross-slide. Orders are received in runs of 100 to 300 pieces. Setup time is reasonable, so the lathe is available between runs for other jobs.

The work is held in three different positions for machining. Shown in Fig. 3 are section views of the surfaces machined in each position. In the first position, view X, a three-jaw chuck grips the work externally on *N*. From the square turret, *B* is faced, then *C* and *D* are hogged out. At the same time, *E* is rough-bored from one of two slide tools carried in the hexagon turret. (This operation is shown in the heading illustration.) After the second slide tool semifinishes the bore, a double-edge form tool in the square turret roughs first *F* and *H*, then *J* and *K*.

In the second position, view Y, the work is reversed in the chuck and gripped on *D* after a reinforcing plug is inserted in the bore *E*. From the square turret, *L* is rough- and finish-faced. Then, using the tracer, *M* and *N* are rough and finish machined. Square turret tools next step-bore *O* and form radius *P*.

Once more, in the third position, view Z, the work is reversed, this time being secured to the faceplate of the machine over a centering plug.

Fig. 3. These section views of the "doughnut" show the stock reduction in the three machining positions. Shaded areas indicate amount of stock removed.



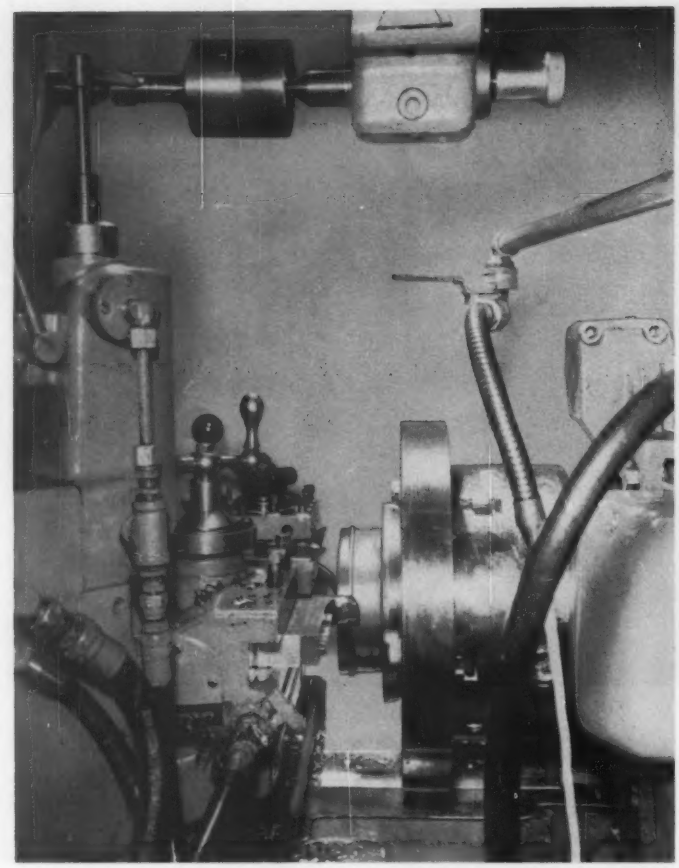


Fig. 4. With work secured over a centering plug, tracer completes radius (F), Fig. 3.

Square turret tools face *Q* and *R*, finish *C*, and blend in the radii *F*, *H*, and *K*. The tracer then finishes *F*, *D*, and *H*. Radius *F* is the smallest traced (1/8 inch) so the tracing tool has a 1/4-inch diameter tip, and the stylus, a 1/4-inch hardened ball brazed on as a tracing surface. In Fig. 4 is a view from the rear of the machine showing this radius being traced.

Next, six pins are inserted in the faceplate to hold the work by bearing on *R*, and the locating plug is removed. The internal diameter *E* is now finish-bored from the hexagon turret and radius S formed from the square turret.

Later, in a separate operation with the work again secured to the faceplate over the centering plug, *K* and *J* are blended into *H*. This operation is performed by the tracer but with an extended tool-holder which cuts at the front of the machine, thus avoiding a heavy feed load in cutting into the radius.

Metal honeycomb core material used in aircraft is trimmed to suit airfoil shapes, and in critical areas the cells are compressed or densified to achieve higher strength on this special machine developed by the Glenn L. Martin Co. The machine consists of a work-table and clamping device to hold the parts and an adjustable roller which runs along tracks on the side of the table.

Portable Milling Equipment for Machining Aircraft Components

By RALPH C. NOURSE, Tool Engineer
Douglas Aircraft Co., Inc.
Long Beach Division
Santa Monica, Calif.

A PORTABLE milling unit having a cutter-head that is fed along a cross-rail for milling wing-attachment areas on aircraft components is being used at the Long Beach Division, Douglas Aircraft Co., Inc. The heading illustration shows this equipment in operation. Surfaces are machined flat within a tolerance of 0.003 inch and to a finish of 32 micro-inches r.m.s.

A problem common to manufacturers of large aircraft is the machined fit required in joining the outer wing to the inner wing. Warpage of the shear-plane surface may cause overstressing of the structural attaching members. Small angularity discrepancies where the wings join may create large deviations at the wing tips.

The attachment surfaces on the wings of large transport planes, manufactured at Long Beach, follow a curved cross-section at the top and bottom of the wings, both left-hand and right-hand. Both the inboard and outboard sections of these wings require machining. To facilitate this operation, the tooling department devised a motor-driven cutter unit that travels on its own track so as to machine these two surfaces. This device can be easily transported and is capable of quick, accurate connection to the work.

The unit is mounted on a straight dovetail track of the cross-rail and is fed in a horizontal direction by means of a lead-screw. A 5-H.P. motor, running at 3600 R.P.M., powers a two-blade carbide cutting tool having a diameter of 5 5/8 inches. This tool covers the face of the flange or attachment surface to be milled, as well as the chord depth of the airfoil surface. A 1/3-H.P. reversible motor drives the milling carriage at a feed rate of 18 inches per minute in either direction. The carriage is automatically stopped at the end of its travel by limit switches.

The portable milling unit is lifted to a wing section by means of a crane from the movable cradle, shown in Fig. 1, on which it is stored between jobs. The operator, from a working platform, attaches the cross-rail to the wing by means of four bolts.

One face of the wing-attachment area is milled in one pass of the cutter—approximately 1/16 inch of metal being removed from 7075 aluminum. The milling head is then rotated 180 degrees on its carriage, as seen in Fig. 2, to locate the cutter in the proper position for milling the opposite chord. The work-piece is finished by this second operation.

Accuracy is governed by the care used in attaching the machine to the work. The four ma-

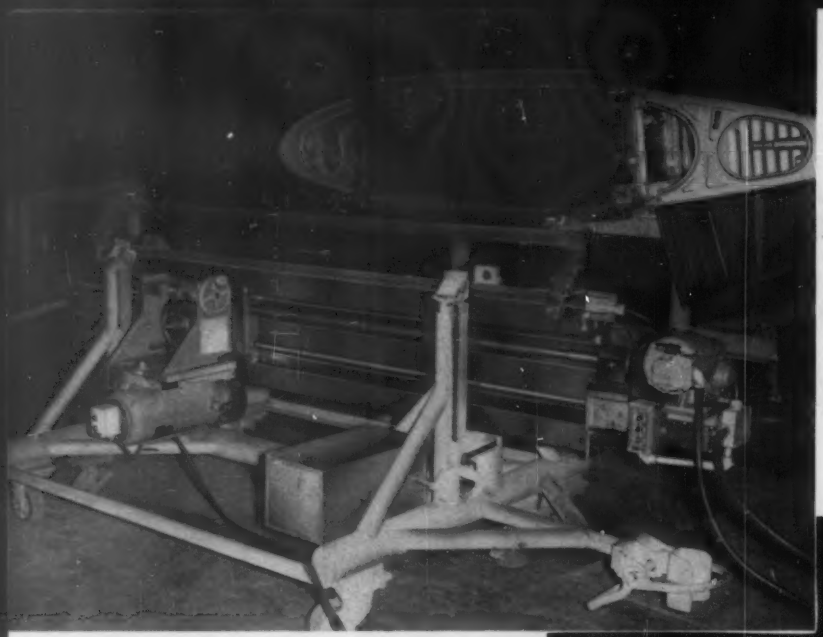


Fig. 1. (Left) Portable milling unit in cradle ready for use in milling an airplane wing section.

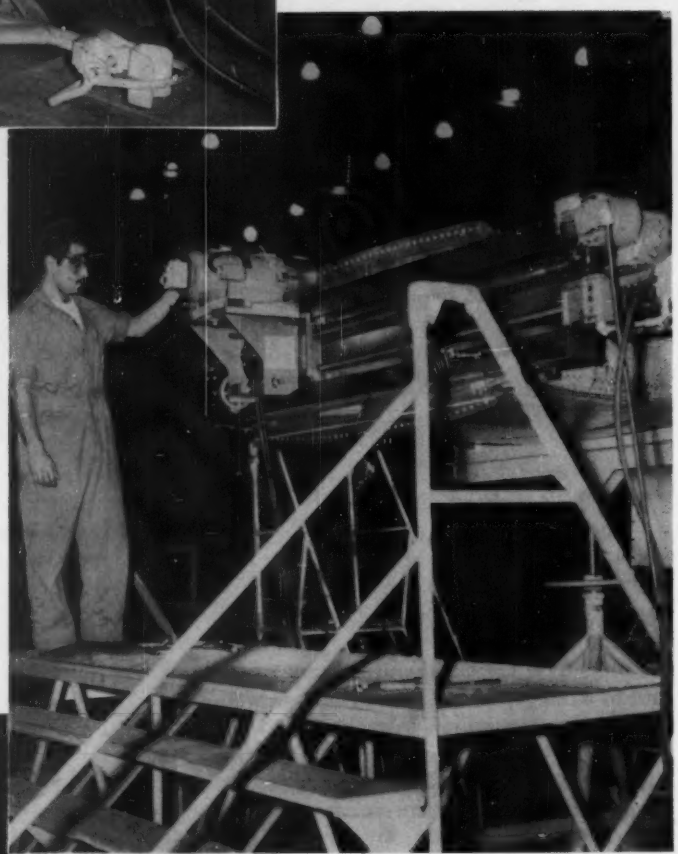


Fig. 2. (Right) After machining the top flange of a wing section, the milling head is indexed 180 degrees to locate the cutter for machining the bottom flange.

Fig. 3. (Left) Machining the bottom flange of the outboard section of a wing. A portable panel that supplies power for the milling unit can be seen at the right.

chined attachment areas to which the milling unit is secured are precision milled before assembly in the wing jig. The assembly jig is made so as to align the four machined parts accurately in one plane as the wing is built. Each of the four areas is bored and tapped to receive the milling unit attaching bolts.

The cradle may be rolled to any convenient line position and does not interfere with other phases of assembly. The portable milling equipment is used in conjunction with a portable electric panel that may be plugged, with a single non-arcing connection, to plant power sources. This electric panel can be seen at the right of Fig. 3. Four electrical plugs handle the power from the panel to the mill.

Multiple-Positioning Stock Feed Applied to Screw Machines

A multiple-spindle screw machine that has been equipped to automatically reposition stock in the several working stations is here illustrated. Repositioning is accomplished on this Greenlee Bros. & Co. automatic by advancing the work to new locations to facilitate the performance of successive operations. This provision enables better machining of long work or the machining of two or three short, simple pieces from the same bar of stock in one cycle.

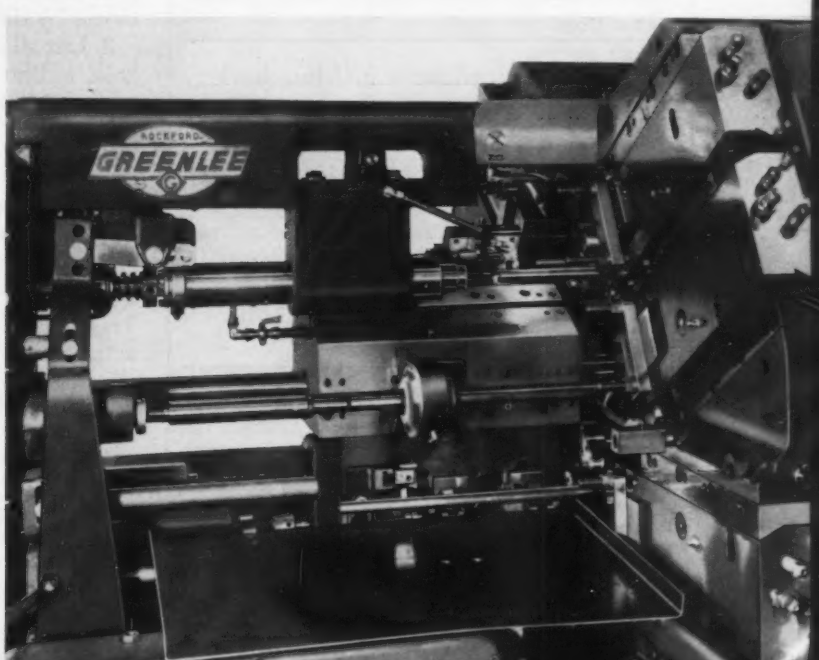
The multiple stock-positioning device is used in connection with a stock reel that has an air-feed arrangement and an automatic control for the work feed-out collet. Stock in the reel is under a constant forward pressure. Therefore, mechanical movements are limited to collet opening and closing.

This multiple feed-out arrangement employs a double-acting air cylinder that is operated from an air-bleeder valve. The valve is actuated by a plate cam located on the end of the stock-feed cam drum. Air-cylinder action moves two collet operating rings located on selected work-spindles. The operating rings control the opening and closing of collets to allow positioning of work.

It is not necessary to remove this special setup in order to use the conventional single-position stock feed. The double-acting air cylinder is simply disconnected, and the regular collet operating cams are mounted on the cam drum. Conventionally, the machine is mechanically timed to feed out stock during the spindle-indexing cycle between the sixth and first work positions.

The accompanying illustration shows a long piece of work being tapped close to the spindle in the fourth working position. The second feed-out occurs during the machine cycle in the fifth working position, and the fully extended work is cut off in the sixth working position.

With this added equipment, up to three stock-feed positions may be obtained. Such an arrangement will allow a long part to be fed out in successive steps. At each position, the work can be machined close to the spindle nose, thus greatly reducing the need for auxiliary stock supports.



Close-up view of a Greenlee automatic screw machine that advances stock to new positions for successive working stations.

How to Take an Accurate Physical Inventory in One Day

By George J. Bevans, Management Engineer
Systems Council, New York, N. Y.

HOWEVER efficient the accounting system used in a plant may be, it is still necessary to reconcile the book inventory records with an annual physical check of materials actually on hand. Two different systems for taking this physical inventory are widely used. One method is to cover all storage areas in the course of a year by checking the stock on a different floor section each successive week. The other method used is to do the whole job at one time.

The advantage of the latter procedure is that it gives an accurate picture of the over-all situation so that all records can be adjusted simultaneously. The traditional objection to taking physical inventory of the whole plant at one time is that it interferes with, or often totally stops, production for several days while the job is being done.

A system for taking inventory in a large plant in a single day has been perfected by Gene H. Kline, a top accounting executive with the General Foods Corporation, in whose plants this method is being successfully used. This process was developed over a period of years for a number of large and small companies in the automotive, aircraft, electrical appliance, and farm-equipment industries. There is no reason why this system cannot be used in any industry.

The complete procedure embraces twelve simple steps:

1. Draw an easily understood diagram of each floor area in the plant to be inventoried. Have sufficient copies made so that each of the two counting teams you will appoint for every area will have a copy. Each supervisory team should also have a copy, and there should be a surplus in case some copies are mislaid.

2. Divide the manpower available for the actual counting into two-man teams and draw up an assignment sheet showing the areas each team is to count. Provide for having each area counted twice, by different teams, to insure accuracy.

3. List all classes of items to be counted in each area, indicating whether each class is to be recorded in pounds, barrels, dozens, gallons, or other units.

4. Select a two-man team to supervise the counting in each area or group of areas. The supervisory team should consist of the section foreman and an accountant to work with him.

5. Obtain an adequate number of patched-system tags, similar to the one shown in Fig. 1. This type of tag allows for dual endorsement of actual count and also for recording each different class of material. These tags should be prenumbered in sequence.

INVENTORY COUNT TAG

No. 4838

SECOND COUNT

Location _____ No. 4838

Quantity _____

Unit of Count _____

Counted By _____

FIRST COUNT

Location _____ No. 4838

Article _____

Description _____

_____

_____

Quantity _____

Unit of Count _____

Counted By _____

Date _____

Fig. 1. This tag aids in obtaining an accurate inventory of material. The counts taken by the first and second teams are marked on the designated stubs and turned in to a supervisory team to be checked.

INVENTORY TAG CONTROL SCHEDULE

Prepared By _____ Date: _____

BUILDING	INVENTORY LOCATION NUMBER	ASSIGNED FOREMAN	ASSIGNED ACCOUNTANT	PRENUMBERED INVENTORY TAGS CHARGED OUT	NUMBER OF TAGS CHARGED OUT	TAGS RETURNED SPOILED OR VOIDED	SIGNATURE OF ACCOUNTANT RECEIVING TAGS
C & C Basement	B-1	Smith	Fletcher	001-075	75		
	B-2	Black	Fletcher	076-150	75		
C & C 1st Floor	PR	Parker	Martin	151-300	150		
C & C Warehouse	W-1	Burns	Hogan	801-900	100		
No. 2 Warehouse	A-1	Mapes	Long	901-1050	150		
Yard (Skids & Drums)		White	Long	1051-1100	50		

Fig. 2. A record of the number of inventory count tags and to whom they are issued is kept on this tag control schedule by the accountant.

6. Give each supervisory team a quantity of tags sufficient for the counting teams assigned to the section under the supervisory team's direction. Record those tag assignments by numbers on an inventory tag control schedule, shown in Fig. 2. Explain to all concerned that every tag issued must be accounted for.

7. Prepare and issue lists of counting instructions for the guidance of each supervisory team and for all counting teams.

8. Hold a meeting with all supervisory teams to discuss with them your typed or mimeographed counting instructions and answer any questions the men may raise.

9. See that the supervisory teams hold a similar meeting with the accounting teams under their respective direction.

10. If tags assigned to a supervisory team for distribution to its counting teams prove insufficient, do not allow the team to borrow any tags from other teams. Insist that they obtain any additional tags needed from a central control so that the tag numbers may be properly recorded on the inventory tag control schedule.

11. The first counting team should attach a tag to each pile or bin that has been counted. This team fills out the lower section of the tag, tears off this stub, and hands it to the supervisory team for that area. The second counting team records its inventory figure on the second section of the tag, tears this stub off, and also turns it in to the supervisory team. The supervisory team should require that the numbers on the tag stubs turned in by the second team agree with the numbers on the tag stubs turned in by the first counting team.

12. The accountant on the supervisory team should check the inventory figure on each tag stub turned in by the second team against the figure on the corresponding stub turned in by the first team and reconcile any variations. No erasures should be made. Any figures that the accountant decides not to use should merely have a line drawn through them. The accountant may also classify, by a symbol on the tag recording the first count, the nature of the material counted; whether it is raw material, material in process, or finished goods. All adjustments in figures should be made on the tag stubs used for the first count. Thus, only these stubs need be considered in the final tabulation made by the counting department to which these stubs should be routed from the control center.

The advantages of this simple procedure for taking physical inventory are that it yields records which are highly accurate, fixes responsibility for any errors, and makes the actual counting work relatively easy for the participants. This simple system eliminates most of the trouble usually incident to the laborious task of taking physical inventory in a manufacturing plant.

* * *

Tool and Die Manufacturers Report High Volume of Orders

The National Tool & Die Manufacturers Association reported at their Ninth Annual Spring Meeting, held recently in Washington, a continued heavy volume of orders for special tooling in most production centers. "There is a strong indication that the contract tool and die industry will better the volume of shipments made in its all-time record year, 1953," said Joseph N. Huser, of Indianapolis, president of the Association. "This year the total is likely to go to $800,000,000. Manufacturers especially active in the purchase of special tooling include those in the automotive, appliance, electrical, electronics, and business-machine fields."

Precision Machining in Miniature

Production flexibility is more desirable than the rigidity of mass-manufacturing techniques. Efficiency is based upon skilled operators, highly specialized tooling, automatic machinery, and methods study based not upon speed-up but upon work simplification.

By H. M. DARDANI
Vice-President, Manufacturing
Miniature Precision Bearings, Inc.
Keene, N. H.

UNCLUTTERED production areas, an immaculate toolroom, and an isolated "white room"—an assembly, inspection, and packaging area that bears a striking resemblance to the interior of a modern hospital—exemplify the type of planning that has gone into the new plant of Miniature Precision Bearings, Inc. in Keene, N. H. The nature of the product warrants such extreme care in production and assembly—miniature ball bearings of all standard types ranging in size from the largest, having an outside diameter of 0.375 inch, down to the smallest currently being produced, having an outside diameter of 0.059 inch and using 0.015-inch diameter balls. Some conception of the size of these ball bearings can be gained from Fig. 1.

More than 500 different sizes of bearings are being manufactured with components being produced in average lots of 5000 pieces. As a result, provisions for quick machine change-over and the design of flexible tooling are a must. The entire production area is planned for the straight-through flow of raw stock from one end of the plant to assembling and packaging at the other end. Machine arrangements in the grinding department were developed by the methods study group with an eye toward work-cycle simplification rather than individual operator speed-up.

Control of the working environment is considered essential. Toward this end, the entire plant is air-conditioned. Operations that produce dirt, grit, or noise are isolated, and electrostatic filters remove oil and coolant mists.

Highly filtered air under a positive pressure

is supplied to the assembly area by a separate air-conditioning unit. Employes must enter through a double set of doors and are required to wear special lint-free hats and smocks before stepping into the main assembly room. Automatic equipment removes dust and dirt from their shoes as they enter.

Bar stock is stored on racks in the warehouse located adjacent to the automatic turning department. Material inventory is kept uncomplicated because only three different metals are used: SAE 52100 high-carbon, chromium alloy bearing steel; AISI Type 440 stainless steel; and beryllium copper alloy.

A battery of Brown & Sharpe automatic screw machines handles all the production turning work. The majority of this work consists of turning and boring ring blanks from solid bar stock. These blanks are machined further to form inner and outer ball-bearing races.

In Fig. 2 can be seen the working drawing for a typical inner race. Only the left-hand side of this drawing pertains to the automatic turning operation which is performed on a No. OOG machine as shown in Fig. 3; the right-hand side shows the race after all subsequent operations have been completed. A combination of high-speed steel and carbide tooling is used in the same setup. Drill life has been lengthened approximately 300 per cent by means of flash chromium plating. This is done within the plant.

In line with the company's policy of flexibility, the tooling for the inner race blanks can be used for any of the three materials that may be run through the machine. The same cams are also used regardless of whether high-carbon steel, stainless-steel, or beryllium copper parts are required. Only the spindle speeds need be altered to suit the material. The speeds being used for machining the illustrated part, and also the production rate for each material, are shown in the accompanying setup data table.

A single-point carbide tool is fed in to bring the periphery of the work almost to the desired turned size. To avoid undesirable marks across the surface, the tool is allowed to take the remaining depth of cut on the return movement of the turret-slide. The bar is then center-drilled with a high-speed steel, chromium-plated tool, following which a carbide form tool advances with the front-slide and cuts 0.005 inch by 45 degree chamfers on the periphery. A high-speed steel, chromium-plated drill rough-forms the bore in the race blank and is followed by a carbide boring tool which brings the hole to the pregrind dimension. A concentricity of 0.0005-inch total indicator reading is held between the two diameters.

Care is taken that a minimum burr is raised by the carbide cut-off blade mounted on the back-slide. Too large a burr might easily lead to difficulties when the faces of the blanks are finished. A finish ranging from 30 to 40 microinches is maintained on the machined surfaces. It can be noted by referring to both drawings in Fig. 2 that a comparatively small amount of material is allowed for grinding—0.004 inch on the outside diameter (0.002 inch per surface) and 0.003 inch in the bore (0.0015 inch per surface).

Both ends of the bore are chamfered at a 45-degree angle in one motion on a company-built double-end chamfering machine, Fig. 4. In a lightning-like cycle, lasting one and one-half seconds, two opposed chamfering tools advance to the work, take the angular cuts, and retract. The 0.007-inch chamfer is held to a tolerance of

Fig. 1. A representative group of miniature ball bearings. Some are so small that a thimble will hold 500 of them.

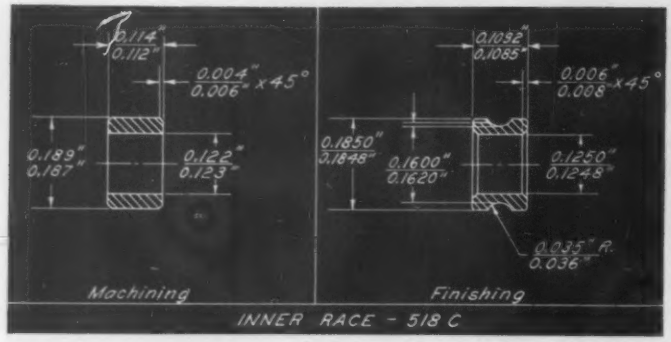


Fig. 2. Machining drawing (left) shows tolerances held on an inner race blank during an automatic screw machine operation. Finishing drawing (right) shows the completed race after all grinding steps have been completed.

plus or minus 0.001 inch with concentricity between the chamfer and the bore being held to 0.0005-inch total indicator reading.

Two automatic drill heads are located at opposite ends of the machine table and drive the two four-fluted carbide chamfering tools at a speed of approximately 3600 R.P.M. Ring blanks of any one size are received from the automatic screw machines and loaded into a circular hopper on top of a work-feed fixture. Mounted on a rotating shaft passing through the center of the hopper are four wire brushes that are positioned at right angles to each other and that extend down into the bucket. The shaft and brushes are rotated at a speed of 1 1/2 R.P.M. by a small electric motor mounted directly beneath the hopper.

As the brushes move around the hopper, the work-pieces drop through a loading slot and into a vertical chute leading into the fixture body. After entering the fixture, the ring blank is stopped and located by a small V-block. The chamfering tools are then fed into the work, each tool being rigidly supported by guide bushings.

A limit switch controls the depth of cut and initiates simultaneous retraction of both drill heads. An air jet directed at the ring blank knocks it off the V-block and onto the machine table. Two screws and two dowel-pins are all that hold the work-feed fixture to the table, so that replacement of the complete unit is no problem. A different fixture assembly is used for each size blank.

Ring blanks are heat-treated to a bright finish in a nitrogen atmosphere before being tumbled and face-ground. The parts are placed in wire baskets and manually advanced through the various stages of an electric furnace. The protective atmosphere is provided by a gas generator that cracks ammonia into its hydrogen and nitrogen elements. These gases are piped to the

Setup Data for Automatic Screw Machine

FOR BEARING SIZES	INNERS	OUTERS		
	518 C			
	CHROMIUM STEEL		STAINLESS STEEL	BERYLLIUM COPPER
MAIN SPINDLE SPEED	4365		3775	4365
DRILL SPINDLE SPEED	2300		2300	3700
CAMS	LEAD	BACK-SLIDE	FRONT-SLIDE	VERTICAL-SLIDE
	2	2 Cut-off	2 Form	

TOOLS	
TURN OUTSIDE DIAMETER	Carbide, single-point
CENTER-DRILL	High-speed steel, chromium-plated
FORM	Carbide
DRILL	High-speed steel, chromium-plated
BORE	Carbide boring tool
CUT-OFF	Carbide cut-off blade

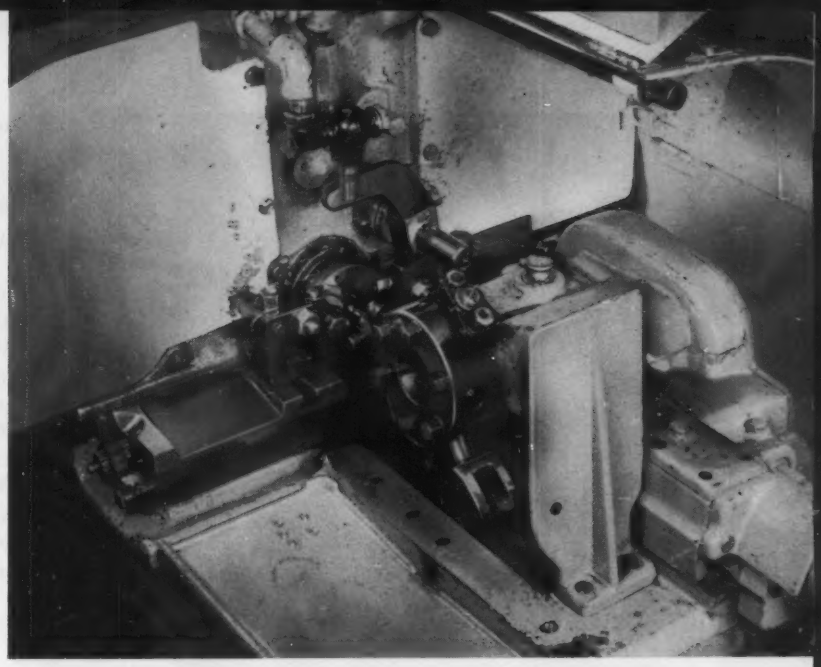


Fig. 3. Producing ring blanks on an automatic screw machine for the inner bearing race illustrated in Fig. 2. The same tools and cams are used regardless of the material being turned. Only the spindle speed is varied.

furnace where the hydrogen is burned off, the nitrogen remaining in the heating chambers.

Bearing parts made of the high-carbon chromium alloy steel are hardened from 62 to 64 Rockwell C. Stainless-steel parts reach 61 to 63 Rockwell C, with the beryllium copper parts being hardened from 30 to 32 Rockwell C. Following heat-treating, the steel parts are stabilized by sub-zero soaking.

The heat-treated parts are tumbled for various lengths of time and with different mixes depending on their size and material. Wet tumbling is used exclusively. Many types of barrel-finishing media are used, such as aluminum oxide (in sizes ranging from pellets down to 180 grit), Vienna (dehydrated) lime, zinc pellets, and assorted shapes of steel pellets.

All miniature ball bearings manufactured by the company conform to ABEC 5 or ABEC 7 tolerances. Although these tolerances permit the bearing width to vary as much as 0.005 inch on the minus side, they are being held to a tolerance of 0.0007 inch. This is because the two faces are used for locating in finishing operations that are to follow.

The races are face-ground on a Norton 16FC vertical lapping machine, shown in the heading illustration. Approximately 0.002 inch of material is removed from each face as the parts are run in contact with two aluminum oxide wheels. In the case of the race shown in Fig. 2, they are brought to their proper width of from 0.1085 to 0.1092 inch, with the two faces being held to a parallelism tolerance of 0.0001 inch. Surface fin-

Fig. 4. Both sides of the bore of these tiny bearing races are chamfered at the same time on this double-end chamfering machine. The parts are handled at the rate of forty per minute.

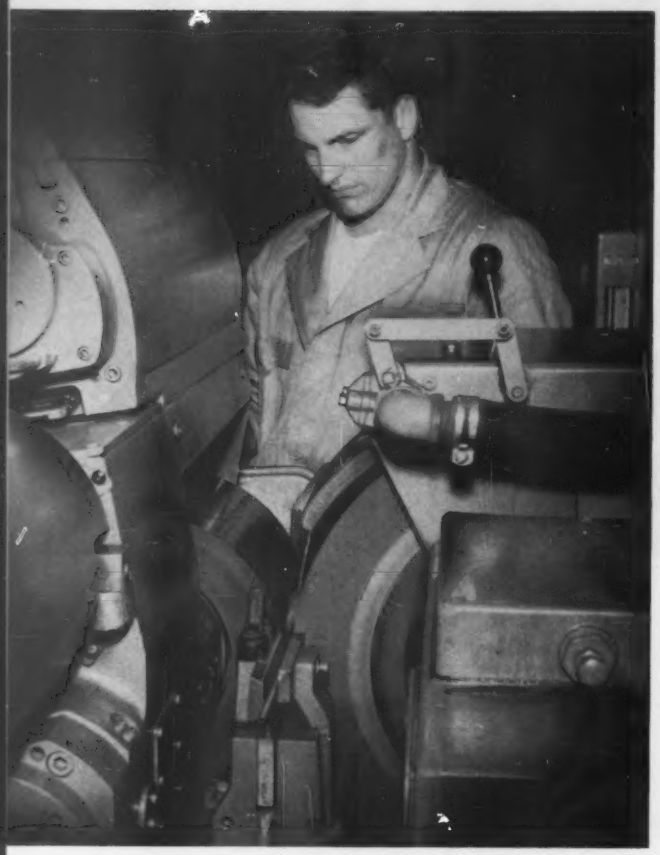


Fig. 5. Centerless grinding the periphery of bearing races. The parts are stacked, forty to fifty at one time, on an arbor.

ishes obtained as a result of this operation range from 4 to 6 micro-inches.

As can be seen in the heading illustration, six openings are provided in the drive plate of the lapping machine to accommodate six work-holders. Each of the work-holders retains 100 bearing races, making a total of 600 races that are handled during each run. One operator, working two machines, can handle 30,000 parts each day. When a difference in thickness is noticed between the races located near the center of the drive plate and those located near the periphery, the two abrasive plates are trued by running them in contact with each other.

The outside diameters of both inner and outer bearing races are finished to size on a Cincinnati No. 2 centerless grinding machine. As previously mentioned, the parts are located by their ground faces. This is done by stacking from forty to fifty of them on an arbor. One of the arbor stacks can be seen emerging from the rear of the grinding machine in Fig. 5. These particular races are being ground to an outside diameter of 0.3125 inch within a tolerance of 0.0002 inch. About 0.004 inch had been allowed on the diameter for the grinding operation. Squareness of the periphery to the finished faces is held to 0.0002 inch, and a surface finish ranging from 6 to 8 micro-inches is obtained.

The inner flange face and the periphery of outer races for flanged type bearings are ground to a diametrical tolerance of 0.0002 inch on a Cincinnati Microcentric grinding machine. Although this machine is rated at a 6-inch diameter capacity, it is tooled up to finish diameters as small as 0.156 inch, shoe type work-guides being employed. An automatic dressing unit is set to dress the 20-inch diameter wheel after every 200 parts have been completed. The contact surface of the wheel is shaped with a double 45-degree bevel, and the work is fed against it at a 45-degree angle so as to form a right-angle shoulder on the bearing race.

Changing over the machine from one size flanged outer race to another requires only the replacement of two carbide shoes and a driving nose and can be accomplished in one hour. To avoid any possible distortion of the thin-wall bearing races, they are checked at the machine on a Moore air-gage unit.

Rough- and finish-grinding of the ball grooves in the bore of outer races is performed on a battery of Bryant internal grinding machines, one of which can be seen in Fig. 6. The machine is equipped with a high-frequency wheel-head (1600-cycle motor) that operates at a speed of 100,000 R.P.M.

Outer races are loaded manually into a vertical feed-chute located adjacent to the machine chuck. Pick-up arm *A*, Fig. 7, removes a workpiece from the feed-chute *B* and inserts it in a 12-segment diaphragm chuck *C*. The ball groove is then ground in a two-stage cycle.

Rough-grinding is the first stage. The wheel-head moves to the left, the tiny abrasive wheel *D* entering the bore and rough-machining the ball groove. After the wheel-head has been backed away, the mounted abrasive wheel is contacted by a diamond-tipped dressing tool *E* and brought to exact shape. Following this, the grinding wheel re-enters the race and finishes the ball groove to size. This cycle is repeated for every part, the abrasive wheel being dressed before each finishing pass. Automatic compensation for wheel wear is a normal machine function.

A tolerance of 0.001 inch is maintained on both the diameter and the curvature of the ball groove. Surface finish is held between 4 and 6 micro-inches. The grinding wheel, when new, is 0.100 inch in diameter and 0.031 inch wide. It is replaced when the outside diameter has been dressed down to 0.065 inch.

Ball grooves on the outside surface of inner

Fig. 6. Ball grooves in outer races are automatically rough- and finish-ground by a small mounted abrasive wheel on this internal grinding machine. The high-frequency wheelhead rotates at 100,000 R.P.M.

bearing races are ground on a Jones & Lamson thread-grinding machine redesigned for this operation. Parts are loaded and unloaded manually and, during grinding, are gripped on both faces. The 20-inch diameter abrasive wheel is trued after eighty pieces have been ground. Also used to machine the grooves on inner races is a Landis 4 H plain grinding machine. A wheel-truing device has been added to the machine. Work-pieces are loaded and unloaded one at a time by the operator.

Two types of machines are being used to finish the bores of the inner races—a Heald Bore-Matic and a Heald Gage-Matic centerless-bore grinding machine. On the Bore-Matic, the parts are held in a diaphragm chuck and are finished to size

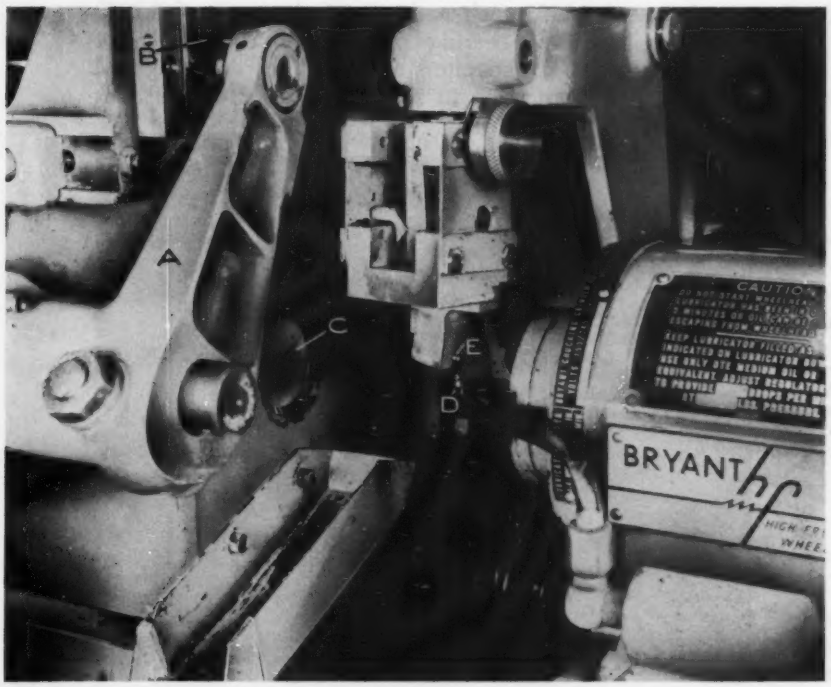


Fig. 7. A close-up view of the operation illustrated in Fig. 6. Parts are transferred from feed-chute (B) to the chuck by pick-up arm (A). An automatic dressing unit trues the wheel before each finishing pass.

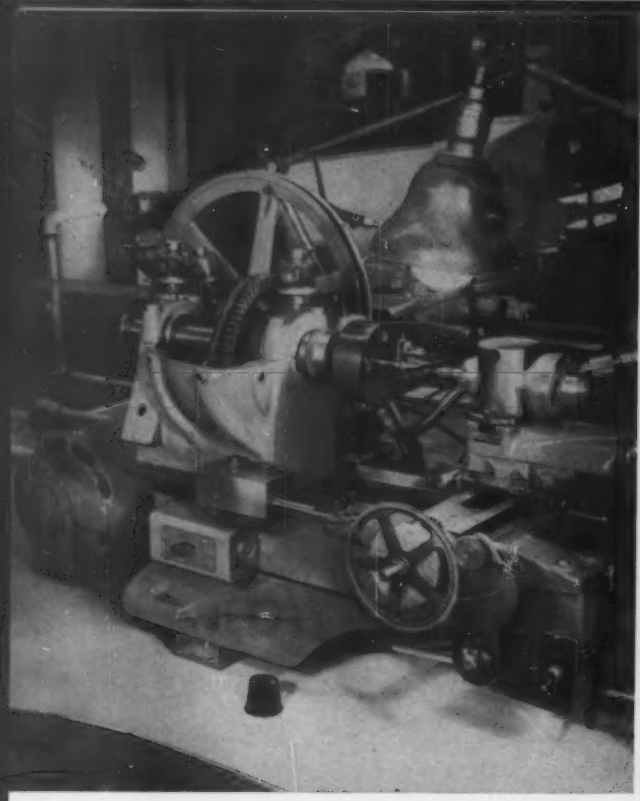


Fig. 8. Filling notches are ground in periphery of inner races on a bank of converted bench lathes. An air-turbine motor on the toolpost drives a small abrasive wheel that is fed against part as lathe spindle reciprocates.

by an end-cutting carbide burr rotating at a speed of 100,000 R.P.M. Holes as small as 0.040 inch in diameter can be handled in this setup.

Races that are finished on the Gage-Matic are supported by two guide rollers and one regulator wheel. Air-gaging is used to check the inside diameter to a tolerance of 0.0002 inch. Surface finish of 4 to 6 micro-inches is required. After skipping five parts, the dressing unit is automatically brought into contact with the grinding wheel.

To permit loading of the balls between the inner and outer bearing races at assembly, small filling notches, approximately 0.006 to 0.010 inch deep, must be provided. These notches are ground on the outer surface of the inner races and extend from one face to the ball groove. Converted bench lathes, such as the one shown in Fig. 8, are set up to handle this operation.

A quick-change, pneumatically actuated work-holding fixture is mounted on the lathe spindle. The work-piece is slipped over a protruding arbor and is face-clamped in place by a pivoting lock-arm located at the rear of the part. Instead of rotating, the lathe spindle is cam-actuated and functions with a reciprocating motion.

Bolted to the toolpost is an Onsrud air-turbine motor that drives a small mounted abrasive wheel. The lathe carriage is fed to the left by an air cylinder until it contacts a stop-bar, at which time the cross-slide is fed in slowly by a special gearing arrangement on the apron. A microswitch limits the cross-slide travel and, therefore, the depth of the filling notch. When the preset depth has been reached, the carriage is automatically backed away, the cross-slide is retracted manually, and the lathe is ready for the next part. Following the grinding of these notches, the ball grooves are lapped to a surface finish of less than 1 micro-inch.

In Fig. 9 can be seen the assembly of a flanged type radial bearing having an outside diameter of 0.3125 inch and a bore diameter of 0.1250 inch. This bearing contains a full complement of balls—no separators are used. The assembly tool is magnetized to simplify transfer of the balls

Fig. 9. Manual assembly of flanged type radial bearings. The dust- and lint-free assembly, inspection, and packaging area is pressurized with filtered and conditioned air to prevent contamination of the tiny bearings with foreign particles.

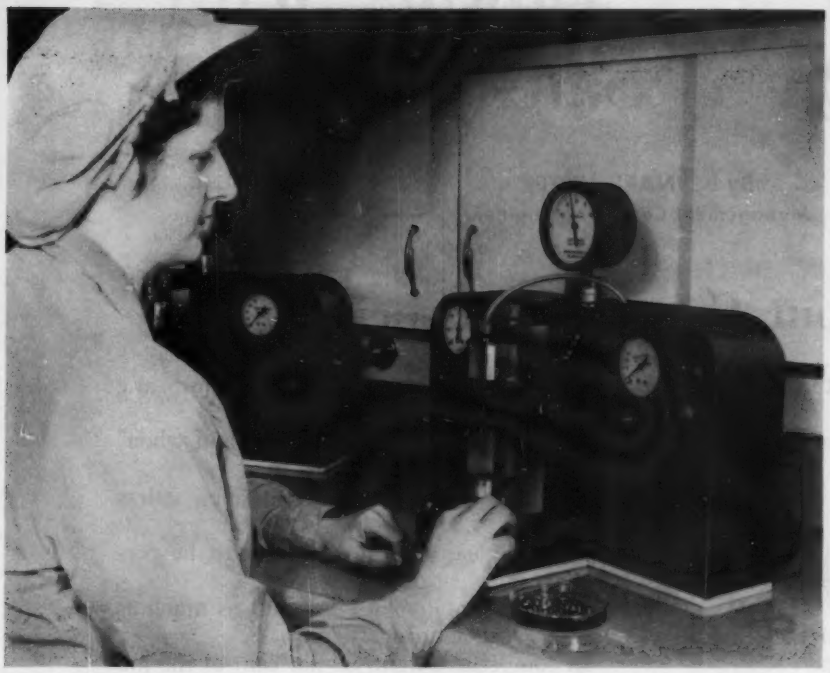


Fig. 10. Radial play in assembled bearings is checked on an air-gage type of inspection unit. With the inner race securely locked, a predetermined load is applied to the outer race. Movement of this member can be read directly on an indicator.

from the tray to the bearing. A small prod extending from the side of the assembly tool is used to snap the balls past the filler notch.

Smaller bearings cannot be assembled with the naked eye. For example, pivot bearings having an outside diameter of 0.059 inch are loaded with 0.015-inch diameter balls under a binocular microscope, manufactured by the American Optical Co.

Many different checks and tests are made on each assembled bearing before it is okayed for packaging and shipping. Sheffield and Moore air gages of both the flow and the contact types are used in numerous places from the time the ring blanks leave the automatic turning department until the bearings are ready for delivery. Surface finishes are carefully ascertained by use of a Profilometer. The bearings are also checked visually under a 12-power microscope for surface defects. Other tests include noise level, starting torque, running torque, axial play, radial play, and radial runout.

Radial play is checked on a bank of company-developed air-gaging units such as the one illustrated in Fig. 10. A completed bearing is slipped onto a shouldered arbor which, in turn, is inserted into the gaging head, drawn up, and locked. The bearing is secured on its inner race only, the outer race and balls being free to move.

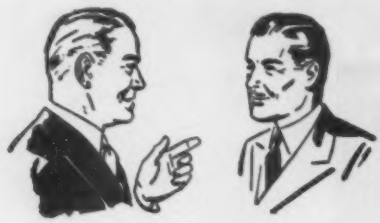
The contact head of a Moore air gage is brought to bear against the top of the bearing. An air cylinder beneath the work-arbor forces a plunger into contact with the bottom of the bearing and exerts a preset load. This load ranges from 2 to 16 ounces, depending on the bearing being checked. As the pressure is applied to the bottom of the outer race, any movement is noted on a gage on top of the instrument housing. A total radial clearance of from 0.0002 to 0.0008 inch is acceptable, again depending on the bearing in question.

* * *

Efficient Machine Tool Lubrication by Use of Daily Routing System

A daily routing system for lubrication of all machine tools has increased service efficiency and effected reductions in costs at the Aircraft Engine Division of Ford Motor Co., Chicago, Ill. Significant features of the system are as follows:

1. The lubrication points on each machine are clearly marked and numbered consecutively.
2. All grades of lubricants are coded by letters.
3. Lubrication routes are assigned to cover specific machines for each oiler.
4. Each day, oilers are furnished with cards reproduced by addressograph for all machines. The card indicates machine number, location, lubrication points, and the grade of lubricant required.
5. The addressograph machine is adjusted to print only information pertinent to the specific date being routed.



Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Sell Your Corporate Associate

"Our zeal in selling the market makes us forget to sell our associate workers."

"We have more sales resistance from other departments than from prospects."

"Something should be done to make every employe sales conscious."

Expressions such as these have become trite. Yet, surprisingly few sales managers have an organized plan of informing their associates about sales matters and making them feel that they should have an interest in selling.

Any manufacturer may be compared to a table supported by four legs: design, production, sales, and finance. Stout connecting braces, such as management, procurement, and personnel, tie these legs together to support a growing business.

You can visualize design from prints and specifications. Passing down the shop aisles, you can see the drama of production. Columns of figures clearly present finance. But, sales? Too many people think selling consists of "taking orders" for they see only slips of paper. Few persons realize that fabricating an order is just as complex as fabricating a machine.

Therefore, sales managers advocate adopting and carrying out, in an orderly way, a sales program directed inward. However, selling has human interest, variety, and action. Don't fail to use sales skill in establishing good will, creating conviction, and getting decision on the part of fellow workers.

Internal selling can be considered in three phases.

The first is to emphasize what interests the buyer and, subsequently, leads to a favorable choice:

A product, well designed and built.
Commitments that are consistently met.
Pleasant, prompt, and intelligently executed business transactions.
A reputation that yields pride of ownership.

The second is to establish what sales engineers do. Explode any foolish notions that they sail through the blue with a smile, shoeshine, and fat billfold. Get these points across:

Selling may demand attentive effort any hour of a twenty-four-hour day.
Sales engineers must go "where and when" they are disinclined.
People don't want to see salesmen unless they can be of help.
Though clean and neat, they must be prepared to get dirty.
Economy applies to selling just as much as to manufacturing.
In competitive fight, 99 per cent of the job may be done and 100 per cent of the order lost.

Each salesman has, undoubtedly, a number of absorbing experiences to illustrate these points.

The third phase deals with departmental relationship and the way in which one department can help another. The crowning point is that every employe helps or retards sales by what he says or does. And so, the "I" of the salesman may land the order, but the "we" of others helps it to land right.

Any sales engineer, part businessman and part engineer—in contact with the market—should regularly come across with design suggestions. No equipment is perfect. There is no last word in design. Don't be discouraged when suggestions are not adopted. One idea out of a hundred makes the search worth-while.

The salesman should also concern himself with production. Too many production men only hear from the sales department when shipments are late or when defects appear in the product. A wrangle may easily spring from lack of discussion about future estimated volume requirements.

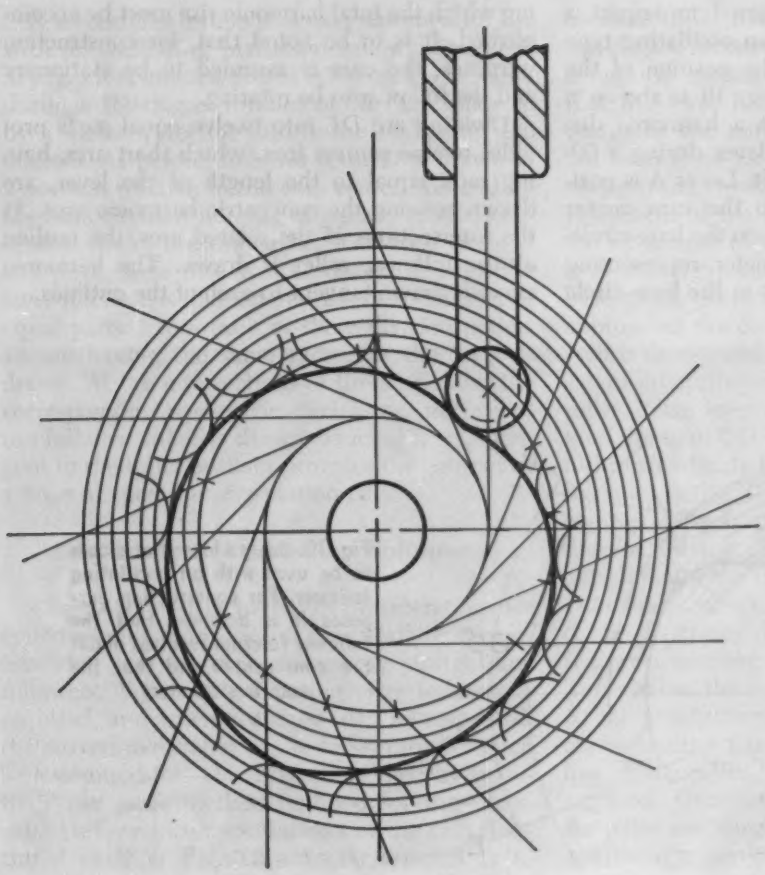
Champion the idea of having key men in other departments get away from aisle, drawing board, or desk and periodically visit customers. Customer contact sharpens interest and ingenuity.

Don't post a "keep out" sign on your sales domain. Rather post one, reading: "ideas and help wanted." Go further than this. Adopt an interesting and varying program of internal selling, using appropriate means of communication. Follow it constantly. It will pay.

MACHINERY'S Reference Section

September 1956

ELEMENTS OF CAM DESIGN



Part 2

By
Robert V. Nicolosi

Elements of Cam Design

Second installment of an article dealing with the function and design of various types of cams. Oscillating, sliding, and rolling type cam followers, and also cam pressure angles are highlighted in this concluding chapter.

By ROBERT V. NICOLOSI

CAMS designed to impart various motions to followers that reciprocate in a straight line were the subject of the first part of this article. Other followers, such as those of the lever type that transmit motion in a curved path, will be discussed in the paragraphs that follow.

Oscillating Plate-Cam Followers

Before a cam can be designed to impart a predetermined movement to an oscillating type follower, it is essential that the position of the fulcrum be established. In Fig. 10 is shown a plate-cam designed to impart a harmonic displacement of 0.500 inch to a lever during a 60-degree rotation of the camshaft. Lever *A* is positioned and drawn relative to the cam center line with the center of its roller on the base circle. A semicircle 0.500 inch in diameter, representing the total rise, is drawn tangent to the base circle and is divided into twelve equal parts. At each division of the semicircle, lines are constructed perpendicular to *BC* and are continued in an arc of 60 degrees around the cam center line.

Line *OD* is drawn between the center of the cam and the fulcrum point of the lever type follower. At an angle of 60 degrees to this line is drawn line *OE*. The sector thus formed defines the prescribed rotation of the lever fulcrum during which the total harmonic rise must be accomplished. It is to be noted that, for construction purposes, the cam is assumed to be stationary and the follower to be rotating.

Dividing arc *DE* into twelve equal parts provides twelve centers from which short arcs, having radii equal to the length of the lever, are drawn crossing the concentric harmonic arcs. At the intersections of the related arcs, the outline of the follower roller is drawn. The harmonic curve is drawn tangent to each of the outlines.

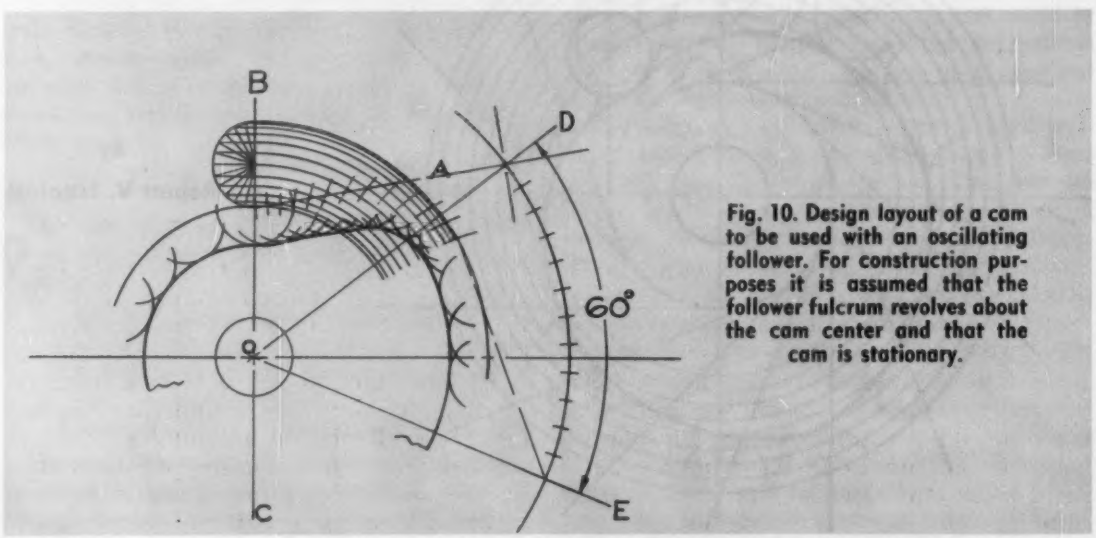


Fig. 10. Design layout of a cam to be used with an oscillating follower. For construction purposes it is assumed that the follower fulcrum revolves about the cam center and that the cam is stationary.

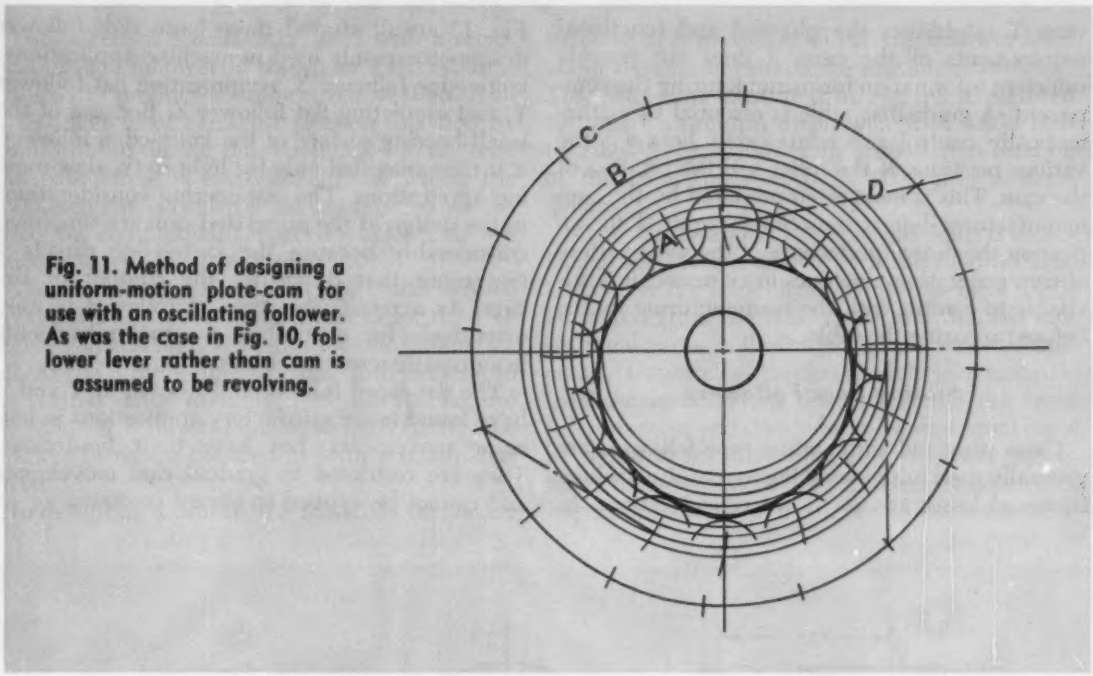


Fig. 11. Method of designing a uniform-motion plate-cam for use with an oscillating follower. As was the case in Fig. 10, follower lever rather than cam is assumed to be revolving.

A second illustration of a cam designed for use with an oscillating plate-cam follower is shown in Fig. 11. A uniform rise of 0.500 inch is required during a 180-degree rotation of the cam, followed by a uniform decline during the remaining 180 degrees. As before, follower lever *D* is drawn in a position relative to the cam center line and on the base circle. A number of equally spaced concentric circles are drawn between base circle *A* and peak circle *B*. Circle *C*, drawn through the lever fulcrum, is divided into the same number of equal parts. From each of these division points, an arc having the same radius as the lever is drawn. At the intersections of these arcs and the corresponding concentric circles, the outline of the follower roller is drawn. Tracing a path tangent to the roller outlines provides the contour of a heart-shaped uniform-motion cam.

Oscillating Cylinder-Cam Followers

All past references to design considerations for cylinder-cams were meant specifically for cases involving the use of reciprocating straight-line followers. When an oscillating type follower is required, and when accuracy is to be respected, the curved movement of the follower roller must be accounted for. This is accomplished by essentially the same method outlined for the plate-cam. Performance requirements of the cam illustrated at X in Fig. 12 are that lever *A* is to oscillate 0.750 inch in both directions within a 180-degree rotation of the camshaft, maintaining a uniform motion throughout. It will be noted that the lever fulcrum is not positioned at the center of the movement as is customary. This has been done for the purpose of presenting an exaggerated condition. At Y is presented a development of the cam circumference, specifying the movement of the cam follower.

A starting point is selected to represent the base pitch position of the follower lever as it approaches the cam rise. The movement of 0.750 inch is drawn and divided into eight equal parts establishing the stepped path of the follower roller. From lever fulcrum *A* is drawn the 90-degree rise span *CD* and the 90-degree decline span *DE* to coordinate the cam rotation with the lever fulcrum. Both *CD* and *DE* are then divided into eight equal parts, each corresponding with the divisions of the line representing the 0.750-inch movement of the follower.

At the point where each division line between *C* and *E* crosses the fulcrum center line, an arc is drawn crossing the movement division lines. This arc has the same radius *B* as does the lever. At the intersection of each of these arcs and the corresponding movement division lines, an outline of the roller is drawn to establish the path required. Once again, the stepped positions of the roller are blended to form a continuous curve.

Although the presentation of the design in

view Y establishes the physical and functional requirements of the cam, it does not provide sufficient information for manufacturing the component. A graduated table is essential to mathematically control the relationship between the various positions of the roller and the rotation of the cam. This is most often prepared by the cam manufacturer but is sometimes required to appear on the drawing. Because of the wide variety of cam generating machines in existence, it is advisable to consult with the manufacturing source before preparing the table.

Sliding Cam Followers

Cams provided with sliding type followers are generally used in slow-moving mechanisms where frictional losses are not major considerations. In Fig. 13 are illustrated three basic slide-follower designs commonly used in machine applications: knife-edge follower X, reciprocating flat follower Y, and oscillating flat follower Z. Because of the small bearing surface of the knife-edge follower, it is recommended only for light-duty, slow-moving applications. The engineering considerations in the design of the associated cam are simplified considerably because the knife-edge directs a movement that duplicates the contour of the cam. As a result, this type of follower is used extensively for controlling the tool movements in automatic screw machines.

The flat-faced followers illustrated at Y and Z have found many satisfactory applications in machine movements, but have their limitations. They are restricted to gradual cam movements and cannot be applied to abrupt contours.

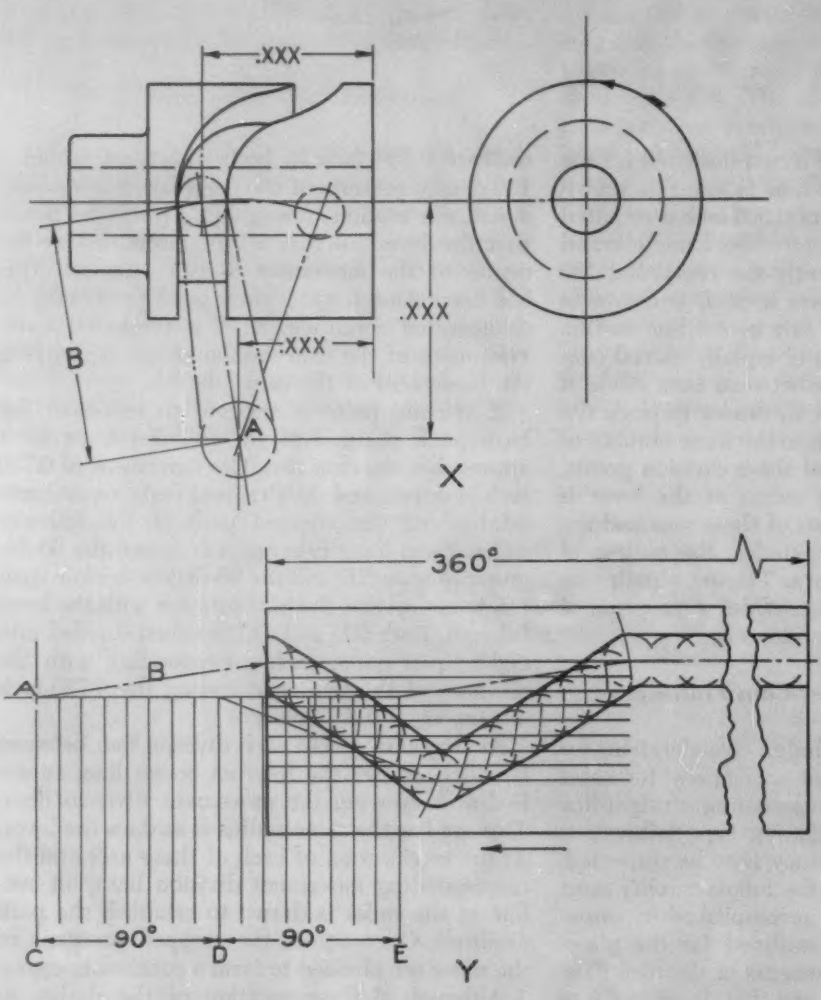


Fig. 12. An oscillating follower is being used in conjunction with the cylinder-cam in view X. Track is constructed on a developed circumference of the cam, as shown in view Y.

The layout of a cam to be used with a reciprocating flat follower is shown in Fig. 14. It is required to produce a uniform rise of 0.500 inch in 180 degrees of camshaft rotation followed by a uniform fall during the remaining 180 degrees. The base circle is established from which the 0.500-inch rise is drawn. This distance is then divided by eight equally spaced circles that are concentric with the base circle.

The entire cam face is divided into sixteen equal parts as shown—eight divisions for the 180-degree rise and eight divisions for the 180-degree fall. At the intersections of concentric circles and the related radial dividing lines, the full face of the follower is drawn tangent to each circle. The follower faces are blended to form a continuous curve.

In designing a cam with a flat-faced oscillating follower, it is necessary to roll the follower lever about the cam to provide for maximum accuracy. The plate-cam illustrated in Fig. 15 is required to impart a uniform displacement of 0.250 inch to a lever type follower in a 90-degree rotation of the cam, followed by a 90-degree uniform decline.

After the location of its fulcrum point is established, the lever is drawn with the follower face tangent to the base circle. The 0.250-inch rise is measured from the base circle and divided into six equal parts, as illustrated by the series of concentric semicircles. Another semicircle, concentric to the cam center, is drawn through the lever fulcrum point and divided into twelve equal parts as required for the 180-degree follower movement. These divisions are provided for constructing the positions of the lever to determine the

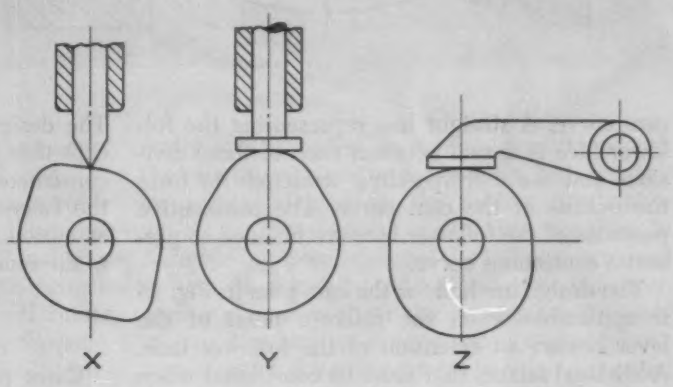


Fig. 13. (Right) The knife-edge follower in view X, the reciprocating flat follower in view Y, and the oscillating flat follower in view Z typify the sliding style of follower used in some slow-moving mechanisms.

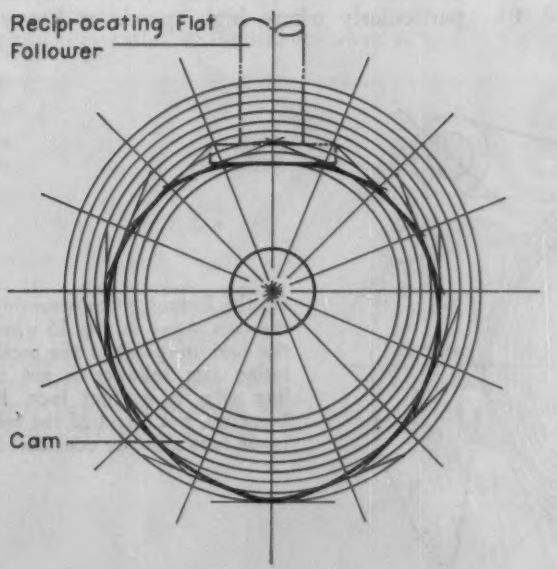


Fig. 14. (Left) Layout of a cam that is to provide a uniform rise and fall when employed with a reciprocating flat follower. Follower face outlines, equally spaced around the cam, are blended to form a continuous curve.

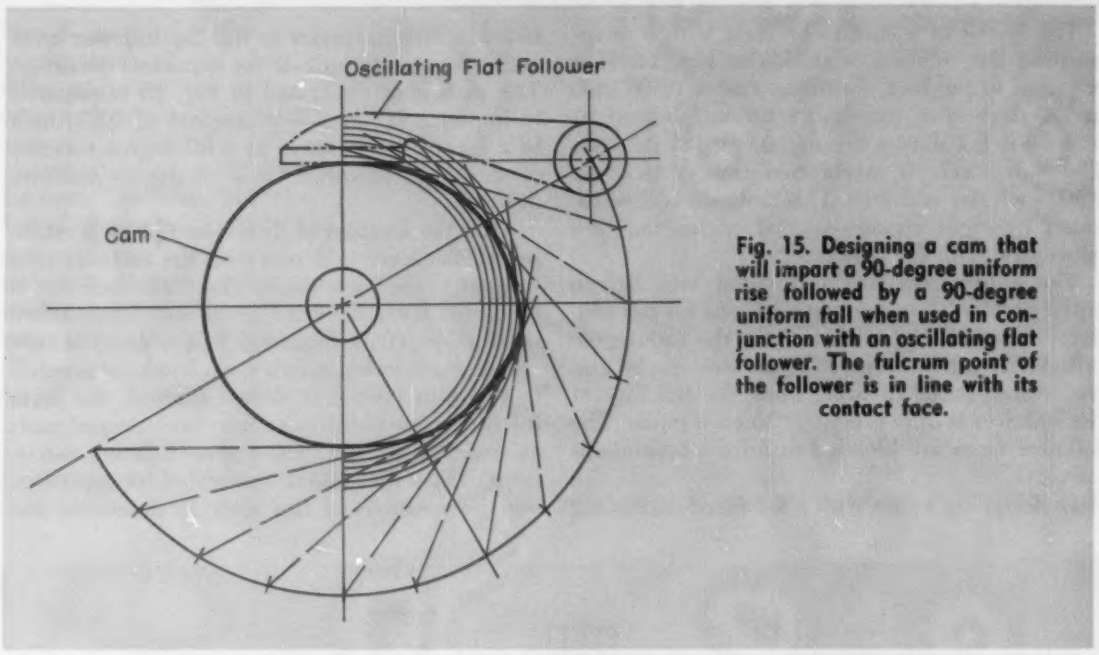


Fig. 15. Designing a cam that will impart a 90-degree uniform rise followed by a 90-degree uniform fall when used in conjunction with an oscillating flat follower. The fulcrum point of the follower is in line with its contact face.

cam curve. A straight line representing the follower face is drawn between each of these divisions and the corresponding semicircle to form the outline of the cam curve. The consecutive positions of the follower face are blended to present a continuous curve.

The design method for the cam seen in Fig. 15 is applicable when the fulcrum point of the lever lies on an extension of the follower face. Additional factors that must be considered when the center of oscillation does not lie on the extended follower face are illustrated in Fig. 16. The design procedure is basically the same except that the offset of the follower face must be constructed at each division along the path of the fulcrum. From these offset circles the true extension of the follower face is drawn tangent to the semicircles dividing the cam rise.

Rolling Cam Followers

Cams provided with roller type followers are almost universally used in automatic machinery, particularly where high speeds or heavy loads

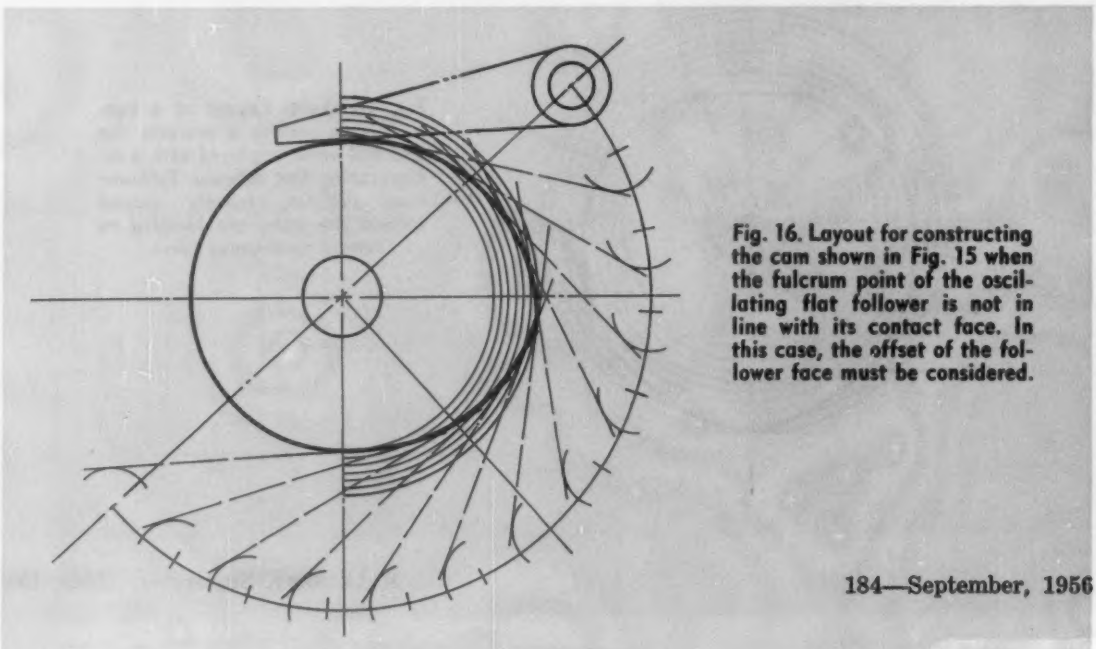


Fig. 16. Layout for constructing the cam shown in Fig. 15 when the fulcrum point of the oscillating flat follower is not in line with its contact face. In this case, the offset of the follower face must be considered.

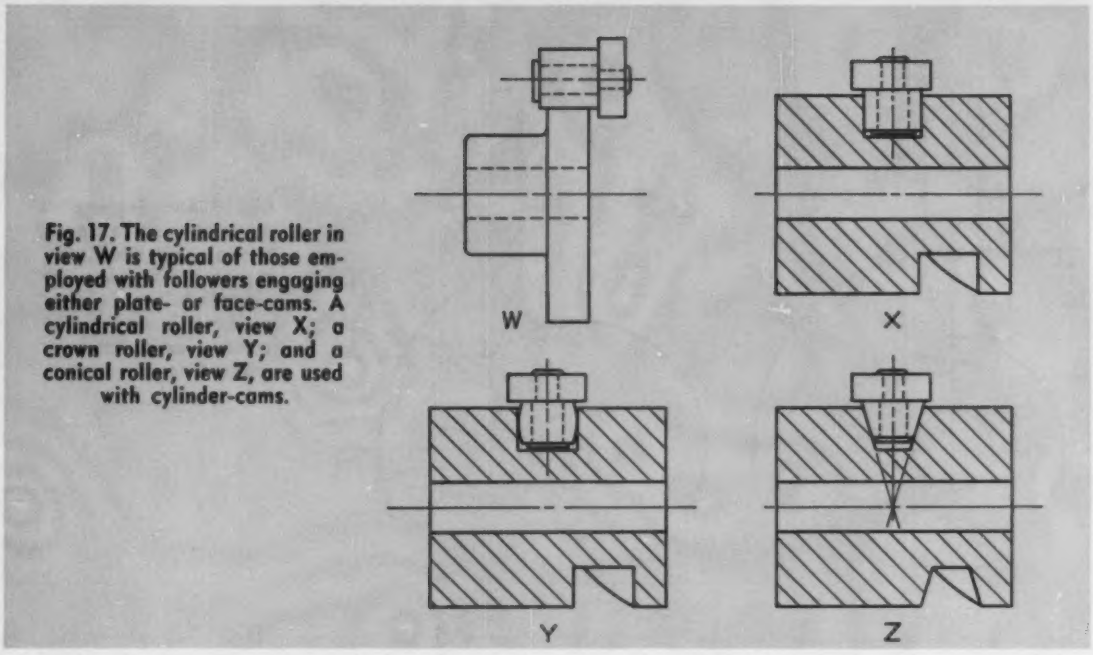


Fig. 17. The cylindrical roller in view W is typical of those employed with followers engaging either plate- or face-cams. A cylindrical roller, view X; a crown roller, view Y; and a conical roller, view Z, are used with cylinder-cams.

are involved. They provide a more permanent installation and offer reduced frictional drag.

It is desirable to use as large a roller as possible so as to reduce its operating speed. To illustrate: if a cam with an average diameter of 3 inches is rotating at a speed of 500 R.P.M., a 1/2-inch diameter follower roller applied to it will rotate at a speed of 3000 R.P.M., neglecting slippage. This condition could defeat the purpose of applying a roller if it becomes the weak link in the design.

In plate-cam installations the follower is generally spring-loaded to maintain contact with the cam throughout the entire cycle. This imposes an additional load on the driving mechanism which, in many cases, is not objectionable. In cams having closed grooves the follower is moved in both directions by a positive action. However, with a plate-cam the roller rotates continuously in one direction as opposed to a closed-groove cam in which the roller rotates in either a forward or reverse direction depending on which side of the groove is contacted. The abrupt reversing of the direction of roller rotation causes skidding

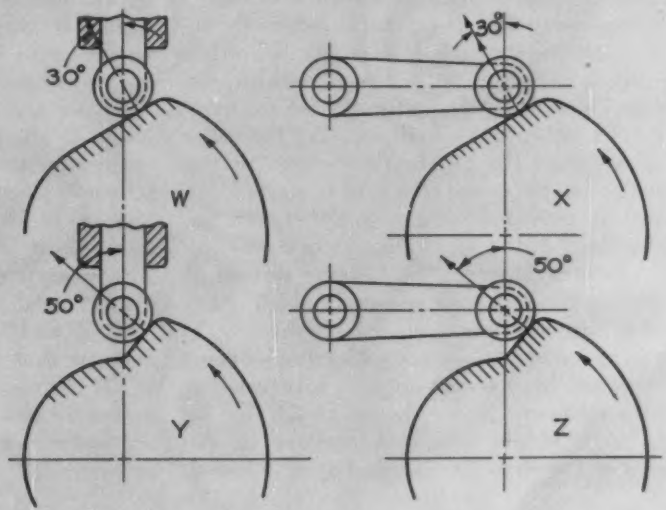


Fig. 18. A satisfactory pressure angle of 30 degrees is presented in the cam and follower combination in views W and X. In views Y and Z, a frequently unsatisfactory pressure angle of 50 degrees is encountered.

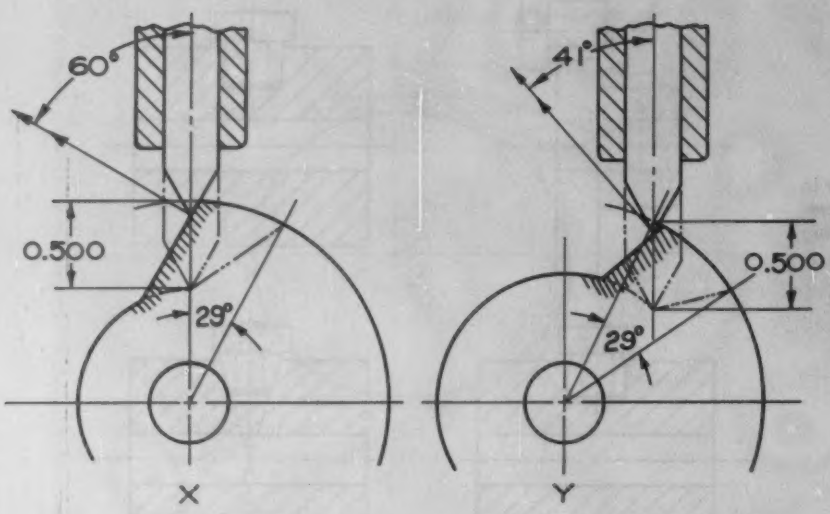


Fig. 19. A 60-degree cam pressure angle in view X blocks normal functioning of the follower. By offsetting the follower as shown in view Y, the pressure angle has been reduced to 41 degrees.

which encourages excessive wearing of both the cam and roller.

Although many closed-groove cam applications do not require a close fit between the roller and the groove to maintain movement accuracy, such a fit is desirable to reduce rotational shock in operation. During each directional change of the follower, the excess clearance between the roller and the groove is suddenly taken up, causing a dynamic shock throughout the mechanism. A relatively close fit assures transmission of the gradual acceleration provided for in the cam groove contour.

Rollers used with plate- and face-cams are cylindrical in shape, as illustrated at W, Fig. 17. This, however, is not the case in cylinder-cam mechanisms that are manufactured to high standards of quality. At X is shown a cylinder-cam being used with a cylindrical roller operating in a groove machined with parallel sides. True rolling action is not realized because the upper and lower portions of the groove are moving at different surface speeds, causing the roller to slip either at the top or the bottom of the groove. To minimize the effects of this condition a crown is provided on the periphery of the roller as illustrated at Y. Although this correction greatly reduces slippage, the bearing surface of the roller in the groove is lessened, which is not desirable for severe working applications.

A roller used in conjunction with cylinder-cams that does not have the drawbacks mentioned is the truncated-cone roller shown at Z. The included angle of the cone is determined by the diameter of the cam—its extended apex is coincident with the cam axis. It is also necessary that the cam groove be machined to a corresponding angle. Although a conical roller develops an end thrust, its advantages justify its application.

Cam Pressure Angles

During normal operation of a cam, side pressure is exerted on the follower lever or slide in the direction of rotation. The magnitude of this side pressure depends on several factors: the friction between the roller and the cam surface; the surface speed of the cam; the mechanical construction of the follower mechanism; and the working pressure angle of the cam-lever combination. The pressure that can be sustained by a follower system without adversely affecting its normal operation is dependent on many factors. Under certain conditions a cam follower may operate with difficulty, or even lock—particularly a slide follower system.

Before a design is established, the maximum pressure angle should be determined and appraised for operational acceptability. Many cam followers operate satisfactorily with pressure angles up to 70 degrees but, as a rule of thumb, an angle of 50 degrees should not be exceeded. This is particularly true in slow-moving, heavily loaded installations.

At W and X in Fig. 18 are shown cam follower systems that present operating pressure angles of 30 degrees, usually resulting in a smoothly operating mechanism. A high percentage of the applied forces are in the direction of the follower movement, thereby providing moderate bearing

pressures. Cam follower systems with an operating pressure angle of 50 degrees, which is unsatisfactory in many applications, are shown at Y and Z. A high percentage of the applied forces are wasted in the direction of the follower bearings which, therefore, require substantial construction to withstand the load.

Pressure angles can be modified by altering the alignment between the cam and the follower, as illustrated at X and Y in Fig. 19. Both cams are to provide a 0.500-inch follower rise within a 29-degree rotation of the camshaft. In view X is shown a reciprocating slide follower that is located on a cam center line and functions at an undesirably large pressure angle of 60 degrees.

In view Y is illustrated a cam and follower arrangement that provides the same required movement yet operates at a more acceptable pressure angle of only 41 degrees. This was accomplished by displacing the slide follower 0.500 inch off the cam center line.

The layout of a cam to be used with an offset slide follower is shown in Fig. 20. A uniform-motion rise of 0.500 inch within 180 degrees of camshaft rotation, followed by a similar fall, is called for. After the relationship of the follower to the cam is established, a construction circle having a radius equal to the offset of the follower is drawn. The follower roller is then drawn on the base circle, which is divided into sixteen equal parts.

Tangents are drawn connecting each of these division points with the follower-offset circle as shown. Another circle concentric with the cam center is drawn 0.500 inch from the base circle. This distance, representing the desired cam rise, is then divided into eight equal parts by the addition of seven equally spaced concentric circles. At the intersections of each circle and their related tangents, roller outlines are drawn and then blended to form a continuous curve. This establishes the cam contour.

Designing a cam to be used with an offset oscillating follower requires no departure from the method just outlined other than the offset presentation of the follower roller. The design execution will remain exactly the same.

In addition to the cams presented, there are numerous others being used in industry to develop specific motions. A complete appreciation not only of the procedures followed in the design of cam systems, but also of the reasons for them, provides the design engineer with flexibility for his creative mind.

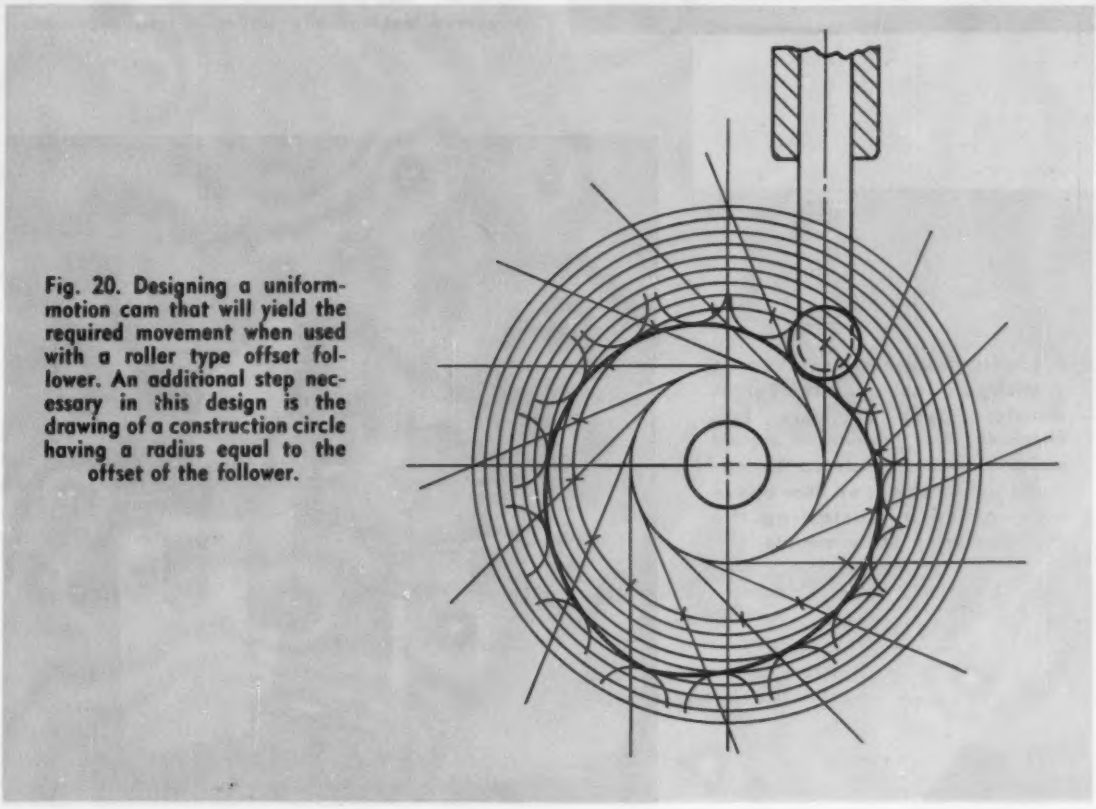


Fig. 20. Designing a uniform-motion cam that will yield the required movement when used with a roller type offset follower. An additional step necessary in this design is the drawing of a construction circle having a radius equal to the offset of the follower.

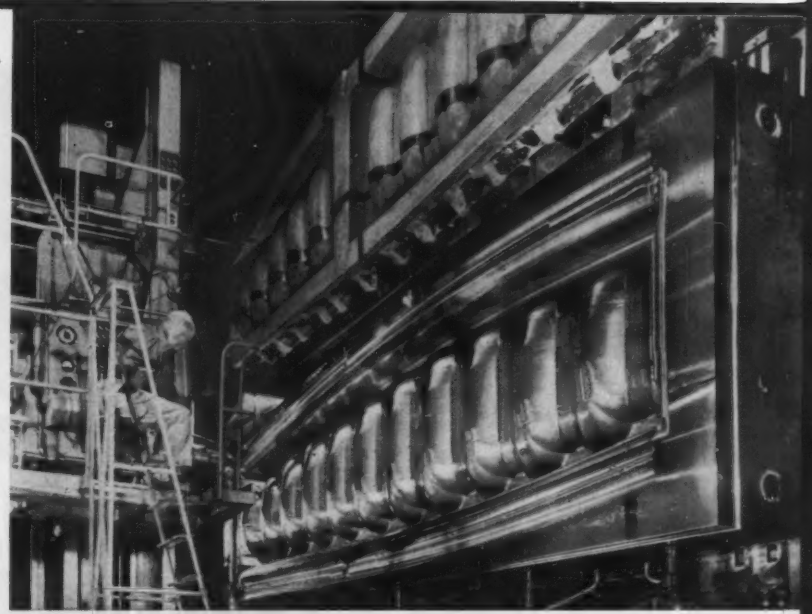
In Shops Around the Country

Camera highlights of some interesting operations performed in various metalworking plants throughout the nation

Vanes are stabbed into position in jet-engine shrouds on a Danly-designed machine at Pratt & Whitney Aircraft, East Hartford, Conn. Each vane is its own piercing punch, thus assuring a tight fit. Magazine feeds blades, which are triggered out radially under 4 tons pressure.

A pinion undergoes inspection on a Michigan Tool gear checker at American Type Founders, Inc., Elizabeth, N. J. Problem of violent indicator flicker produced by operation of machines on floor above was solved by installing the checker on Barry mounts.

Sinking world's largest closed die on a Keller machine at the United States Air Force Heavy Press Plant, operated by Alcoa, at Cleveland, Ohio. Plaster models of the cavity were made in two sections to minimize distortion. The die weighs 30 tons. The closed-die forging is a 3000-pound aluminum section for the Martin XP6M SeaMaster.

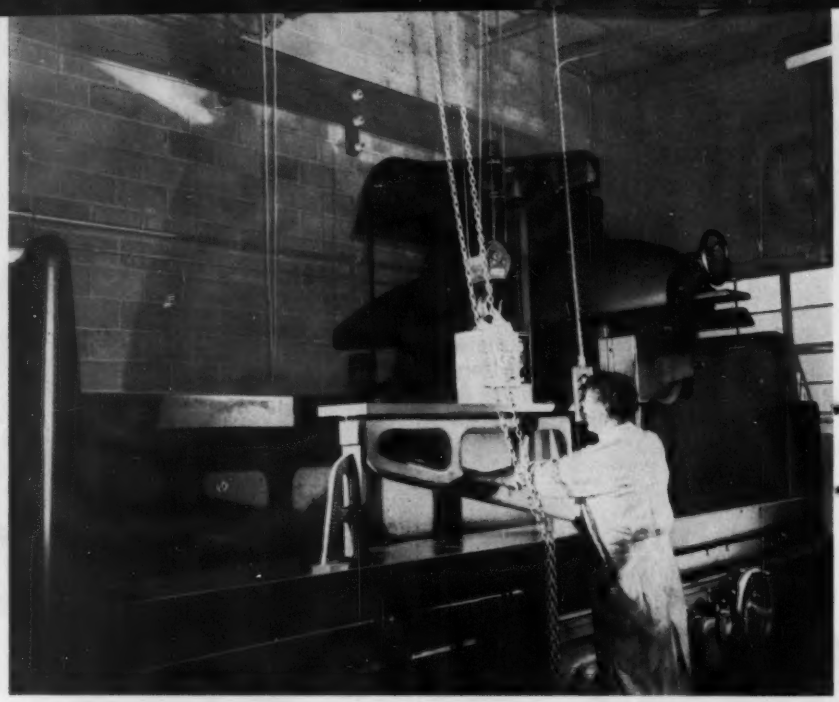


An automatic submerged-arc welding operation on an Expert machine at the Buick Motor Division, Flint, Mich., joins the cover to the rear of the axle housing "banjo." Housing rotates slowly in an inclined plane around banjo axis. Since cover is elliptical, Lincoln head moves in and out during welding.

Mine Safety Appliances Co., Pittsburgh, Pa., uses its Soundscope to track down potentially harmful industrial noises. Here the instrument takes sound pressure level readings at a punch press.

Grinding Meehanite Angle-Plates Accurately

By JOHN E. HYLER



LARGE angle-plates made of Meehanite iron are ground within a tolerance of 0.0002 inch over a length of 60 inches in the plant of the Machine Products Corporation, Detroit, Mich. The operation is performed on Mattison horizontal surface grinding machines set up as shown in the accompanying illustrations.

Considerable care is required in handling the heavy angle-plates, as well as during the actual machining. The work is moved to and from the machine table by an electric hoist which is suspended from a bridge crane. A portable 1-ton Sundstrand lift magnet attached to the hoist hook, as seen in Fig. 1, facilitates lifting the Meehanite castings as well as other ferrous parts.

To obtain the accuracy required in grinding the angle-plates, precision height-blocks are used in setting up the work on the grinding machine table. These blocks support the front end of the angle-plate and expedite accurate leveling of the

Fig. 1. (Above) A 1-ton lifting magnet, manipulated by an electric hoist suspended from a bridge crane, facilitates setting up angle-plates on a surface grinding machine. Precision height-blocks support the front end of the work-piece.

Fig. 2. (Left) Meehanite angle-plate being ground on a horizontal surface grinding machine within a tolerance of 0.0002 inch over the entire surface.

work-piece. The Machine Products Corporation makes these height-blocks in its own plant to suit this special type of work.

The Meehanite angle-plates are ground with a 36-grain aluminum-oxide, vitrified-bond, Carborundum wheel that runs at 1150 R.P.M. The transverse feed of the wheel is 2 inches per pass and the depth of cut is 0.002 inch. A table speed of 150 feet per minute is employed. Cimcool, reduced 100 to 1, is used as a coolant. The work-pieces are ground to a surface finish of 25 micro-inches maximum.

Formerly, the angle-plates were scraped by hand—a process which consumed twice the time now required for the operation. Because the work-pieces are high and narrow, they must be fastened securely to the grinder table. The smooth movement of the hydraulically powered table eliminates vibration or jerking motion.

Aluminum angle-plates are ground on the same machine to similar tolerances and surface finish. Since the lifting magnet cannot be used in handling these non-ferrous work-pieces, a rope sling is employed with the regular hoist hook.

Applications of Low-Nickel Stainless Steels Increasing

To meet demands for more stainless steel in both consumer and industrial products, many fabricators in the metalworking industry are using, or have under test, AISI Types 201 and 202 stainless steel—new low-nickel, high-manganese alternates to conventional austenitic types. These are the first of the low-nickel, austenitic stainless steels to be recognized by the industry and, as such, are a new family of stainless steels.

The physical and mechanical properties of the two new types are very similar to those of the equivalent higher nickel Types 301 and 302. Yield strength, ultimate tensile strength, and hardness in the annealed condition are higher but not of sufficiently greater degree to seriously affect production practices. No difficulty is expected with atmospheric corrosion, since chromium-nickel-manganese steels have been in service for fifteen years without any evidence of corrosion due to normal atmospheric conditions.

In draw-bench forming, roll-forming, and brake bending operations, Types 201 and 202 can be handled in exactly the same manner as 301 and 302, respectively. In both shallow and deep draw applications, the chromium-nickel-manganese types have behaved almost identically to their chromium-nickel counterparts with, however, some important exceptions. Usually, hold-down pressure must be adjusted to prevent wrinkling which might occur due to the higher yield strength. Draws up to 36 inches in diameter by 10 inches deep are being made without difficulty.

Other routine operations covered in a recent survey where no noticeable difference could be found include simple machining operations, soldering, spot-welding, stamping, polishing, and flash-plating. In most cases, the higher strength of the low-nickel steels will have an almost unnoticeable effect on production operations.

Considerable test and production welding of the 201 and 202 steels proves them to have much the same welding characteristics as the 301 and 302 grades. Some test-results indicate a reduced tendency toward intergranular precipitation of chromium carbide. When filler wire or electrodes are used, they can be of either conventional chromium-nickel analyses or chromium-nickel-manganese analysis to match the base composition.

Washfountain bowls are formed to size in a single draw from stock 0.095 inch thick. Blanks for 36-inch bowls are 48 inches in diameter, and larger bowls are drawn from 66-inch blanks. In tests with Type 202 stainless steel, no production changes were required.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Nickel Alloy Developed for Gas Turbine Components

Centerless-ground, hot-rolled nickel-alloy bar stock in sizes from 1/2 inch to 2 inches in diameter can be obtained from the Utica Drop Forge & Tool Corporation, Utica, N. Y. Other shapes can be supplied in the hand-forged or rolled form. "Udimet 500," as this alloy is called, is ideally suited for applications where high strength at elevated temperatures is required. Its composition is as follows: carbon, 0.15 per cent max.; sulphur, 0.015 per cent max.; aluminum, 2.50 to 3.25 per cent; titanium, 2.50 to 3.25 per cent; molybdenum, 3.00 to 5.00 per cent; chromium, 15.00 to 20.00 per cent; cobalt, 13.00 to 20.00 per cent; iron, 4.00 per cent max.; silicon, 0.75 per cent max.; manganese, 0.75 per cent max.; and nickel, the balance. The average hardness, as heat-treated, is 38 to 40 on the Rockwell C scale.

The ultimate tensile strength of this material ranges from about 195,000 pounds per square inch at room temperature to 160,000 pounds per square inch at 1350 degrees F. and decreases proportionately to about 25,000 pounds per square inch at 1850 degrees F.

The machinability of Udimet 500 is comparable to that of other age-hardenable high-temperature alloys. Drilling, turning, and similar operations can best be performed with the material in the solution-treated condition. Carbide tooling should be used at low speeds and feeds to avoid work hardening. Grinding is preferable for finishing if the material is in the age-hardened condition.

Corrosion- and Wear-Resistant Thermoplastics that are Bondable

"Bondized" Califilm (fluorothene, Kel-F) and "Bondized" Kelon-F (Kel-F) sheets are specially treated thermoplastic sheet materials that can be bonded to a variety of materials by using ordinary commercially available adhesives. These materials have been made available by Shamban Engineering Co., 11617 W. Jefferson Blvd., Culver City, Calif. They can be cemented to steel, aluminum, wood, plastics, cardboard, or rubber.

"Bondized" thermosheets are especially suited for parts that encounter wear or corrosive conditions such as liners and coverings for tanks, jigs and fixtures, rollers, bushings, valve facings, and machine parts. "Bondized" Califilm is available in thicknesses ranging from 0.005 inch to 0.015 inch, in widths up to 16 inches. "Bondized" Kelon-F sheets are available, treated on one or both sides, in thicknesses ranging from 0.015 inch to 0.250 inch.

Hydraulic and Circulating Oils with Long-Lasting Performance

"Balanced" oils with performance characteristics that "stay young" during most of a machine's service life are now available to users of hydraulically operated equipment and machines employing circulation systems, according to Socony Mobil Oil Co., Inc., 26 Broadway, New York 4, N. Y. Designated "Mobil D.T.E. Oils," these hydraulic and circulating oils, eight in number, were designed to meet the demands of closer tolerances, increased speeds, heavier loads, and higher operating or local "hot spot" temperatures. These oils were formulated to provide desired over-all performance with respect to oxidation resistance, protection against rusting and wear, ability to separate from water, and foam resistance.

Self-Hardening Liquid Chemical for Locking Threaded Fasteners

A method of locking ordinary threaded fasteners using a chemical sealant called "Loctite" has been announced by the American Sealants Co., Trinity College, P. O. Box 260, Hartford 6, Conn. This liquid, having the appearance of kerosene, hardens automatically in the joints between metal parts, sealing the joints pressure-tight and bonding the parts together with a tough heat- and oil-resistant plastic.

Fasteners may be wetted by tumbling briefly with the sealant. Severe vibration will not loosen the bond between treated fasteners since the mating threads become filled with hardened plastic.

Treated nuts and bolts can easily be removed with ordinary tools. Uses indicated are the treating of fasteners and sleeve joints and the sealing of porous welds and leaky threads in pipelines and process equipment.

Conversion Coating which Improves Paint Adherence and Resists Corrosion

A conversion coating for aluminum and zinc—designed to meet Specification MIL C-5541—has been announced by Oakite Products, Inc., 126 Rector St., New York 6, N. Y. The product, called "Oakite ChromiCoat," imparts corrosion resistance and improves paint adherence. The coating becomes integral with the metal surface and reduces paint chipping and flaking. If the surface should be damaged after application, the treatment is said to confine corrosion within the area of the exposed metal. Corrosion does not creep under the undamaged paint to cause blistering.

The product is used in concentrations of 2 to 3 ounces per gallon of water at temperatures up to 100 degrees F. in either a tank or washing machine. Solutions may be kept in stainless-steel or some plastic-lined steel tanks.

Chemically Inert, All-Purpose Floor Absorbent that is Dust-Free

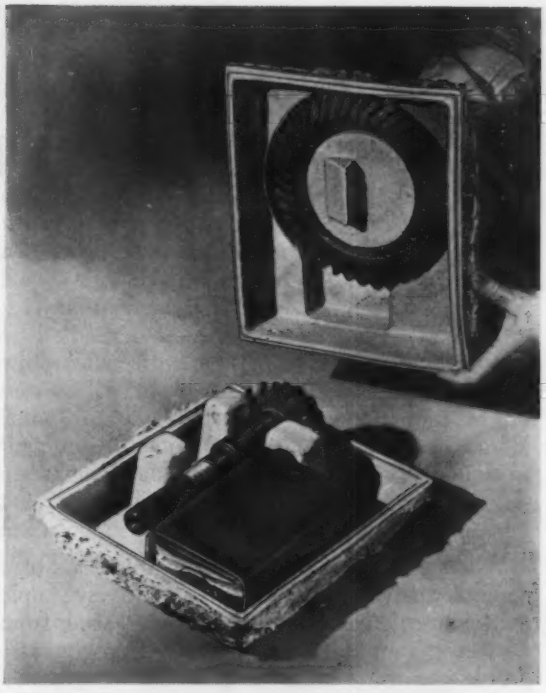
An industrial floor absorbent which soaks up more than its own weight in oils, greases, and other fluids has been developed by the Diversey Corporation, 1820 Roscoe St., Chicago 13, Ill. Called "Pickup," this absorbent provides greater floor coverage per bag because of its low density. It provides a dry, non-slip floor surface which helps to reduce personnel injuries and fire hazards.

"Pickup" is said to be dust-free for easy handling and application. It is unaffected by heat or cold and can be stored for long periods without caking or deterioration.

Low-Cost Method of Packaging with Molded Paper Pulp

The design and manufacture of pulp molds called "Fibre Forms" for industrial packaging and materials handling has been announced by Fibre Forming Division, Arvey Corporation, Olean, N. Y. These forms, which are available in a wide range of shapes, thicknesses, and sizes, are made of such materials as waste news, kraft, cane, and other fibers. When required, such qualities as extra strength, waterproofness, and oil resistance can be built into these packaging materials. The saving in their use comes as a result of elimination of labor of folding, wrapping or assembling.

Applications include the packaging of television sets; appliances; glass and ceramic products; automotive parts, including fenders, radiators, and gears; and electrical and electronic products and assemblies. Each package is individually designed to hold its contents snugly, giving support without further wrapping or employing other packing materials. The accompanying photograph shows a typical application.



Automotive parts such as these hypoid gears are conveniently packaged in a molded paper pulp container. Such containers are designated "Fibre Forms."

Tablet for Measuring Temperatures of 100 Degrees F.

The development of a tablet called "Tempil° Pellet for 100 degrees F." has been announced by the Tempil° Corporation, 132 W. 22nd St., New York 11, N. Y. These pellets begin to liquefy along the line of contact between the pellet and the surface when the surface upon which they rest reaches a temperature of 100 degrees F. The first sign of liquefaction is the temperature signal.

The pellets have been developed for testing the effectiveness of insulations, regulating heating and cooling systems, testing prototypes for heat-transfer characteristics, and testing production-line work where 100 degrees F. is the prescribed operating temperature. Shipment of these low-temperature pellets is limited to the off-summer months. Pellets must be stored under mild refrigeration during hot weather.

MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Selecting Gears for a Specified Planetary Ratio

When the numbers of teeth in the gears of a planetary drive are known, it is a relatively simple matter to calculate the ratio of the gearing from whatever formula is applicable. The converse problem, finding suitable gears for a specified ratio, is not always as easy; it is complicated by the fact that the gears selected must not only produce the required ratio but they must also satisfy certain center-distance requirements. As an example, consider the planetary gear formula

$$R = 1 - \frac{C}{Y} \times \frac{X}{B}$$

In this formula, R is the ratio of gearing desired, C and Y are the tooth numbers of one pair of mating gears, and X and B are the tooth numbers of the other pair of mating gears. Pair C, Y operates on the same center distance as pair X, B so that the selection of suitable gears is complicated by the fact that the sum of the teeth, $C+Y$, must be equal to the sum of the teeth, $X+B$.

It is sometimes possible to meet the center distance requirements by making pair C, Y of a different diametral pitch than pair X, B. However, when either of the two following methods can be applied, a simpler solution using a single diametral pitch is obtained.

Solution A:

$$R = 1 - \frac{C}{Y} \times \frac{X}{B}, \text{ or}$$

$$(1 - R) = \frac{C}{Y} \times \frac{X}{B} \qquad (1)$$

For this particular gear train, pairs $\frac{C}{Y}$ and $\frac{X}{B}$ operate at the same center distance and must satisfy the condition $X + B = C + Y$ in order for the gears to mesh properly. The easiest way to satisfy this condition is to make $C = X$ and $Y = B$, in which case the problem is reduced to finding the ratio of a single pair of gears.

$$(1 - R) = \frac{C}{Y} \times \frac{C}{Y}, \text{ since } \frac{C}{Y} = \frac{X}{B}$$

$$(1 - R) = \left(\frac{C}{Y}\right)^2$$

$$\log (1 - R) = 2 \log \frac{C}{Y} \qquad (2)$$

As an example showing how Equation (2) can be used to determine the gears required, assume that $R = 0.9497$. Then,

$$\log (1 - R) = 2 \log \frac{C}{Y}$$

$$\log (1 - 0.9497) = \log 0.0503 = 8.70157 - 10^*$$

$$2 \log \frac{C}{Y} = 8.70157 - 10$$

$$\log \frac{C}{Y} = \frac{8.70157 - 10}{2} = \frac{18.70157 - 20}{2} = 9.35078 - 10$$

On page 156†, the nearest logarithm of a gear ratio corresponding to 9.35078–10 is 9.3508274–10, and the gear ratio is given as $\frac{24}{107}$. Checking this gear ratio in the formula

$$R = 1 - \frac{C}{Y} \times \frac{X}{B}$$

$$0.9497 = 1 - \frac{24 \times 24}{107 \times 107} = 0.94969$$

* From log tables in "MACHINERY'S Handbook"
† From tables in "14,000 Gear Ratios"

The error resulting from the use of this pair of gears is:

$$\begin{array}{r} 0.94970 \\ 0.94969 \\ \hline 0.00001 \end{array}$$

Solution B:

Starting with Equation (1),

$$(1 - R) = \frac{C}{Y} \times \frac{X}{B}$$

$$(1 - 0.9497) = 0.0503 = \frac{C}{Y} \times \frac{X}{B}$$

Again assuming $\frac{C}{Y} = \frac{X}{B}$, then $\frac{C}{Y} = \sqrt{0.0503} = 0.2242766$.

Entering the table on page 156, the pair $\frac{24}{107}$ is located.

Instead of using the pair $\frac{24}{107}$ for both $\frac{X}{B}$ and $\frac{C}{Y}$, a variation may be employed by taking one pair, say $\frac{X}{B} = \frac{23}{108}$ and the other pair $\frac{C}{Y} = \frac{25}{106}$. These values are above and below the ratio $\frac{24}{107}$ and are neighboring values taken from the table. Checking,

$$R = 1 - \frac{C}{Y} \times \frac{X}{B} = 1 - \frac{25}{106} \times \frac{23}{108} = 0.94977,$$

an error of:

$$\begin{array}{r} 0.94977 \\ 0.94970 \\ \hline 0.00007 \end{array}$$

* * *

Historical Tools Wanted

The United States National Museum at Washington, D. C., is engaged in enlarging its collections and exhibits for its new Hall of Tools. It is planned to have a historical series of exhibits showing the development of hand tools, mechanical tools, power tools, precision tools, and automatic tools.

The Museum would like to obtain originals, models, or replicas of old tools and especially of those which mark a fundamental advance in the development of tools. It would also like to obtain drawings, photographs, and plans of old tools, as well as professional papers and photographs of men and firms who played important parts in the development of the tool industry.

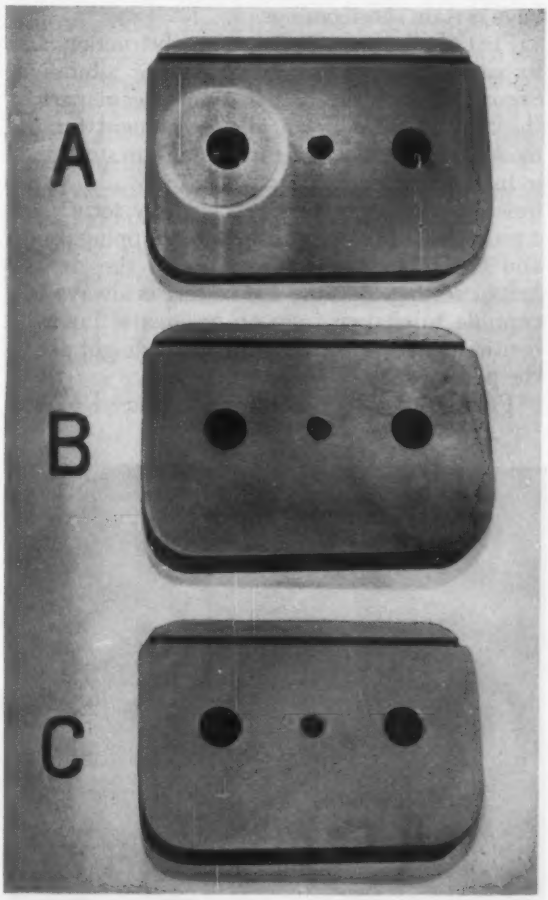
* * *

At road speeds of 60 miles per hour, approximately 3000 gallons, or 60 barrels, of water are circulated through the average automobile radiator per hour, according to engineers with Harrison Radiator Division of General Motors.

Flame-Plating Increases Life of Anvil Blocks

Anvil blocks used in a blanking machine for cardboard boxes are being given extended life by the addition of a tungsten-carbide coating. The coating is applied by a flame-plating process developed by The Linde Air Products Co., a Division of Union Carbide and Carbon Corporation, New York City.

In the course of this process, the temperature of the base metal does not exceed 400 degrees F. while the coating of tungsten carbide is being deposited. Because of this, finished parts can be flame-plated without the danger of distortion, and the physical properties of the parent metal remain unchanged. The tungsten carbide may be left in the as-coated condition, as in the anvil block application, or it may be brought to a fine finish by either grinding or lapping.



Worn-out flame-plated anvil blocks that have been stripped of the used coating and then replated with tungsten carbide are shown at (A), (B), and (C), respectively.

TOOL ENGINEERING Ideas

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Tooling Ball with Removable Feature

By M. A. McCartney, Torrance, Calif.

Tooling balls enjoy high popularity as reference points of measurement. These balls are accurate and versatile and are often preferred to the use of a machined surface, dowel-pin, or tooling button. The conventional tooling ball, however, does have certain shortcomings.

First of all, the ball creates an obstruction, and its surface is exposed to damage or alteration. Secondly, since the ball is a permanent part of the tool, it becomes an idle investment for the most part, especially when the tool is in storage.

In the third place, the ball cannot always be quickly, accurately, and permanently set. Often, a great deal of time is consumed in tapping it into and out of its base pad to obtain the desired height setting. Because the setting is always susceptible to change from an accidental bump, a constant check must be made of its height above the pad.

Finally, the stem of the conventional tooling ball offers interference when certain angular readings are attempted, as will be explained. It is also desirable to have a choice of readings taken from any one of the six possible perpendicular directions extending outward from the center of the ball (height, width, and length measurements in either direction outward).

Now, a patented tooling ball check unit, Fig. 1, eliminates or lessens the extent of these shortcomings. Its principal feature is that the plug supporting the ball proper is removable and may be used in conjunction with any number of base pads, each of which is permanently attached to a particular tool.

Shouldered plug *A* has a 45-degree top, to which the stem of ball *B* is welded. The length of the stem is such that the center of the ball and the center line of the plug coincide. At the bottom of the plug is a shank which is a close fit in a central hole in base pad *C*.

The base pad is of two-piece construction to facilitate the milling of inspection port *D*. In addition, there is a brass retaining screw *E* in the upper piece and a height-setting screw *F* and a staking port *G* in the lower piece.

Initial setting of the height of the plug is made by adjusting screw *F*. The inspection port provides a means of checking the contact surfaces of the adjusting screw and shank, either visually or with a feeler gage. Tampering with the setting can be avoided by covering the head of the screw with solder and inserting a punch in the staking port and forcing the adjacent wall section against the thread of the screw.

The brass retaining screw secures the plug in position and cancels out the effect of any play between the plug and the base pad that might affect the accuracy of the tooling ball during a

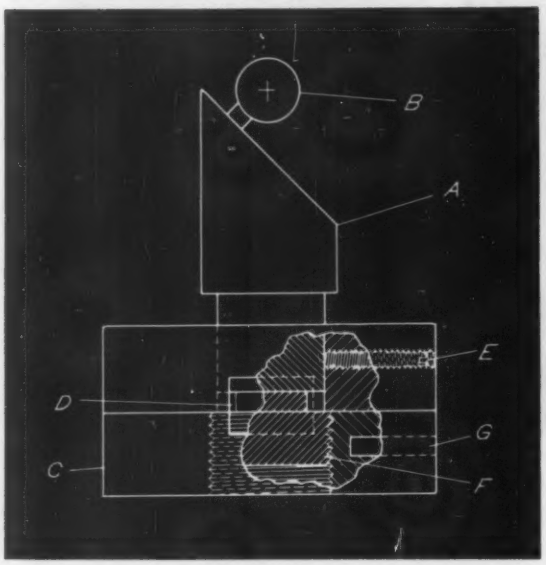


Fig. 1. Since plug body (A) is removable, it may be used with any number of base pads (C).

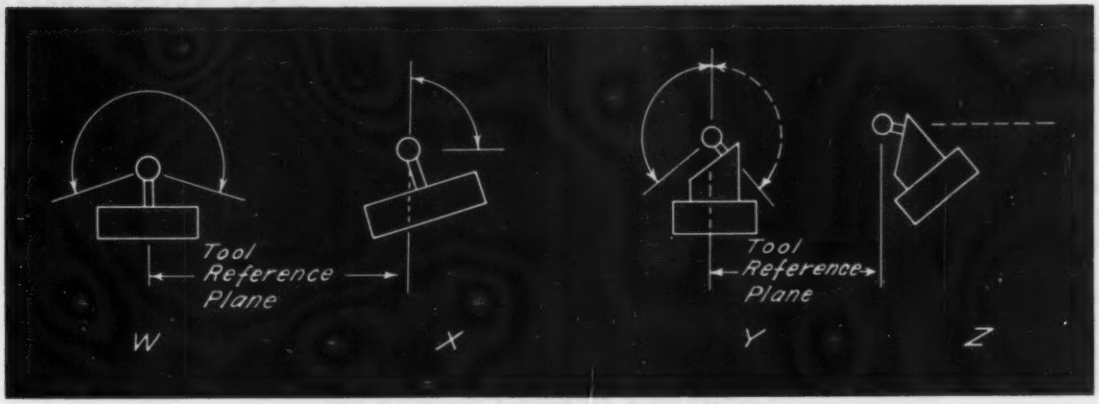


Fig. 2. In each view, the arrows indicate the extent of the accessible reading surface.

rotation of the unit. This is done by the pressure of the screw, which assures that the shank of the plug will bear against the same surface each time a reading is taken from the ball. Inspection seals applied to the heads of the two bolts used in standard practice to secure the base pad to the tool prevent all possible alterations of the original reference plane setting.

In Fig. 2 are diagrams comparing the accessible reading surfaces of a conventional tooling ball and a removable tooling ball. The arrows in views W and X indicate the accessible reading surface of a conventional tooling ball; in view W, the base pad is normal to the tool reference plane, and, in view X, it is at an angle to it. A much larger reading surface is presented by the removable tooling ball, views Y and Z. In view Y, with the base pad normal to the tool reference plane, the surface represented by the solid arrow is accessible; and by revolving the plug 180 degrees on its axis, the surface represented by the broken arrow is accessible. Likewise, in view Z, where the base pad is at an angle to the tool reference plane, readings can be made from the ball in any one of six directions required—with the plug in the position illustrated or revolved 180 degrees on its axis.

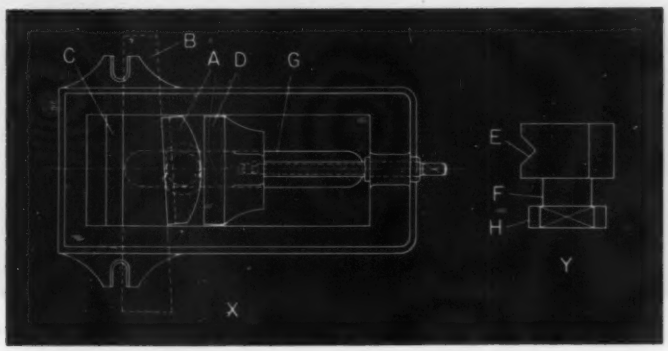
Vise Attachment Aids in Gripping Tapered Work

By W. M. HALLIDAY, Southport, England

Gripping either flat or round tapered work-pieces between the parallel jaws of a standard machine vise usually requires makeshift packing of the jaws. This practice frequently results in unreliable retention of the part, leading to inaccurate machining due to the tendency of the work-piece to shift.

A simple attachment *A*, that facilitates holding tapered components, is shown mounted in a machine vise at X in the accompanying illustration. Both work-piece *B* (shown in broken lines) and the head of the attachment are gripped between vise jaws *C* and *D*. The length of attachment *A* is about the same as the length of the vise jaws.

Attachment for conventional machine vise facilitates the gripping of either flat or round tapered work-pieces.



One side of the attachment head is milled to a straight surface, the opposite side being arc-shaped. This curved side is formed to a radius approximately equal to the length of the part. The thickness of the attachment head, which can be seen more clearly at Y, is about equal to the height of the vise jaws. A 90-degree V-shaped groove *E* is machined along the flat side of the head to aid in holding cylindrical work-pieces.

Formed integrally on the under side of the attachment head is a cylindrical neck *F*. The diameter of this necked portion must be slightly smaller than the width of slot *G* in the base of the vise. Collar *H*, which is integral with neck *F*, prevents the attachment from being accidentally removed from between the vise jaws. Two opposite sides of the collar have machined flats to facilitate insertion into slot *G*.

In use, the vise attachment is positioned between work-piece *B* and movable vise jaw *D*, as shown. When the movable jaw is advanced and tightened against the arc-shaped portion of the attachment head, a swiveling motion takes place and continues until the flat side of the head is in full contact with the work. The component to be machined is thereby gripped securely.

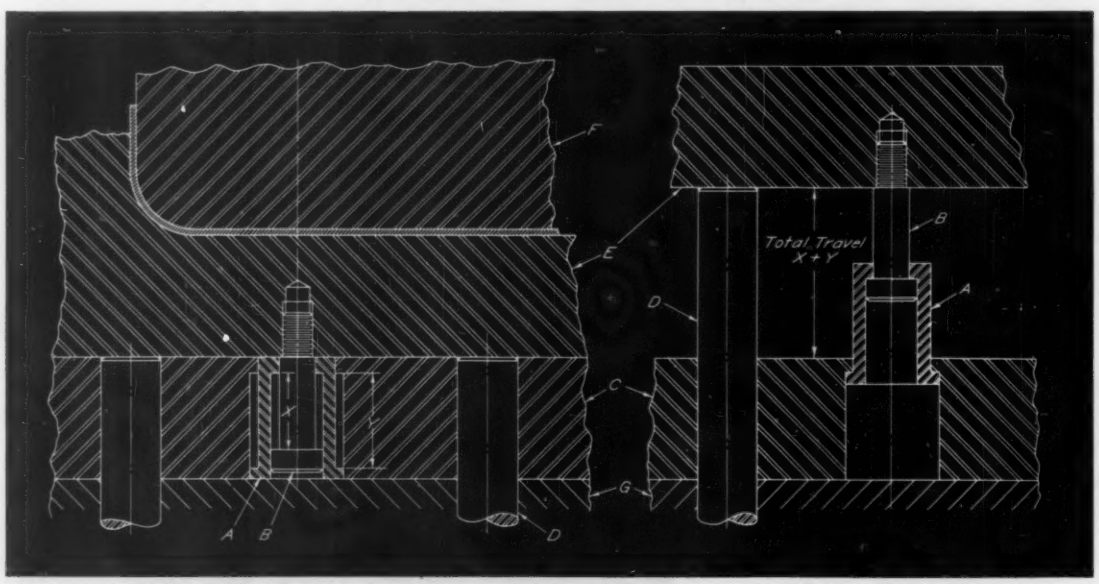
Telescoping Bushing that Increases Stripper-Bolt Travel

By Roger Isetts, Kenosha, Wis.

When designing large forming, blanking, or drawing dies, it is sometimes impossible to obtain enough stripper-bolt travel. The extent of this movement is confined to the thickness of the die-shoe. One way to overcome the condition is to place risers on the bottom of the die-shoe. However, this method is not only costly but often cannot be accomplished because of the limited opening of the press. The illustrated solution to this problem is both simple and inexpensive.

The telescoping bushing *A* is counterbored to receive the stripper-bolt *B*. Die-shoe *C*, in turn, is counterbored to be a slip fit in the telescoping bushing. In the open position, shown at the right, pressure-pins *D* support the die *E* to which the stripper-bolts are attached. As the punch *F* descends, the telescoping bushing drops down on bolster plate *G*, and the stripper-bolt retracts into the bushing. This is the closed position, seen at the left. The total travel can be computed by adding distance *Y*, from the bushing shoulder to the bottom of the counterbore in the die-shoe, to distance *X*, from the shoulder of the stripper-bolt to the bottom of the counterbore in the bushing, when the die is closed.

If still additional travel is necessary, the bushing *A* can be made to telescope into a second, larger bushing. However, this method is seldom used as most dies do not need an extreme amount of travel.



Details of die provided with stripper-bolt that telescopes into bushing to permit additional travel.

INGENIOUS *Mechanisms*

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

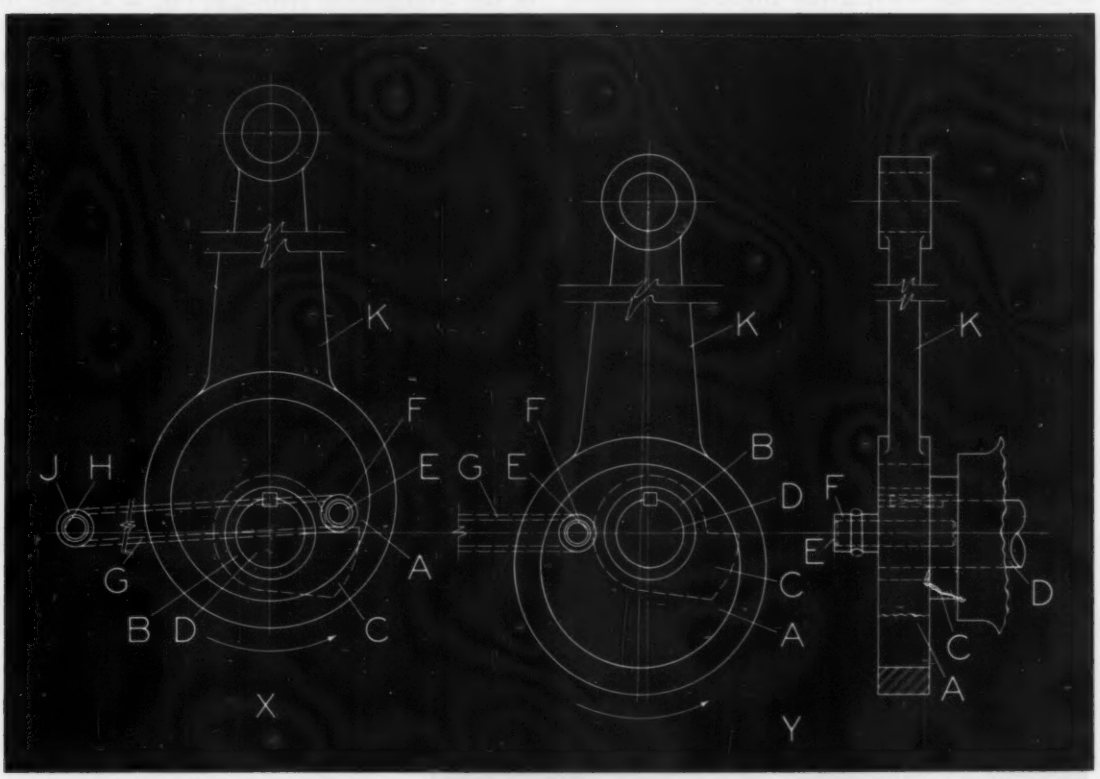
Rapid Return and Dwell Period Provided by Spring-Loaded Eccentric

By L. KASPER, Philadelphia, Pa.

A conventional eccentric and connecting-rod were used to apply holding pressure on a wire product during a machine-forming operation. Although this setup was satisfactory for the job at hand, a product design change made it necessary to modify the clamping motion slightly to furnish a quicker release of the wire part. This revised mechanism is shown in the accompanying illustration.

Eccentric *A* is free to rotate on hub *B* of carrier dog *C*. The carrier dog is, in turn, keyed to shaft *D*, which rotates in the direction indicated by the arrow. Pin *E* is the only connection between the eccentric and the dog. The pin, passing through eccentric *A*, contacts carrier dog *C* during part of the operating cycle.

The end of pin *E* that protrudes in front of the eccentric supports bushing *F*. An external annular groove cut into the bushing carries one end of tension spring *G*. A pin *H* and a bushing *J*, sup-



Modified eccentric provides rapid return of machine-slide followed by a dwell period.

ported by the machine frame, carry the opposite end of the spring. The machine-slide to be reciprocated (not shown) is attached to the upper end of connecting-rod *K*.

When the mechanism is functioning, carrier dog *C* rotates with shaft *D* in a counterclockwise direction until the dog contacts the end of pin *E*. Further movement of shaft *D* will cause eccentric *A* to rotate, at the same time extending spring *G*. The eccentric, as shown at X, is in its uppermost position, or point of greatest pressure application to the work. Pin *E*, at this point, is slightly above the center of shaft *D*. Continued rotation of the eccentric will cause the high-pressure point to be passed, at which time spring *G* will pull the eccentric sharply in its normal direction of rotation. As a result of this movement, connecting-rod *K* and its attached machine-slide undergo a rapid partial return.

At Y in the illustration can be seen the position assumed by eccentric *A* and pin *E* at the end of their spring-induced rotation. The tension of spring *G* prevents additional rotation of the eccentric until carrier dog *C* once again contacts pin *E*. Thus, in addition to a rapid partial return of the machine-slide, a dwell period is provided.

Adjustable Oscillating Movement Derived from Rotating Shaft

By Paul Grodzinski, London, England

A crank drive design to convert rotary motion to an oscillating motion having uniform angular velocity was described on page 200 of the January 1952 issue of Machinery. This mechanism has been refined by changing it to a reverting type drive having both the driving and driven axes coaxial and by providing a means of crank-arm adjustment for altering the angle of oscillation. The drive units here illustrated incorporate this design improvement.

A plan view and a diagrammatic side view of the reverting crank mechanism are seen in Fig. 1. Rotary driving crank *A* imparts a swinging movement to arm *B* through the action of coupler rod *C*. A second coupler rod *D*, also mounted on arm *B*, transmits an oscillating movement to crank *E*. It may be noted that cranks *A* and *E* are mounted coaxially. With this arrangement, all moving members can be contained within a single housing, which may be filled with oil.

Adjustment of the effective length of the crank may be made with the unit in operation by means of the arrangement shown in Fig. 2. Cranks *A'* and *E'*, together with their respective shafts, are bored through to receive cylindrical rack *F* with a sliding fit. Pinion gear *G*, shown at Y in the illustration, meshes with the cylindrical rack. Gear *G* is pinned to threaded shaft *H*. Square nut *J*, which is threaded on shaft *H*, rides within a guide-slot in the crank body. This nut is secured

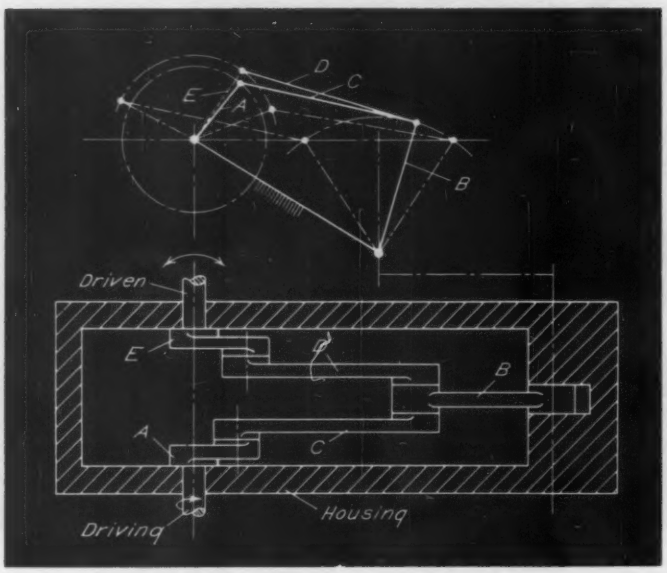


Fig. 1. Compact mechanism converts rotary motion into an oscillating movement having uniform angular velocity.

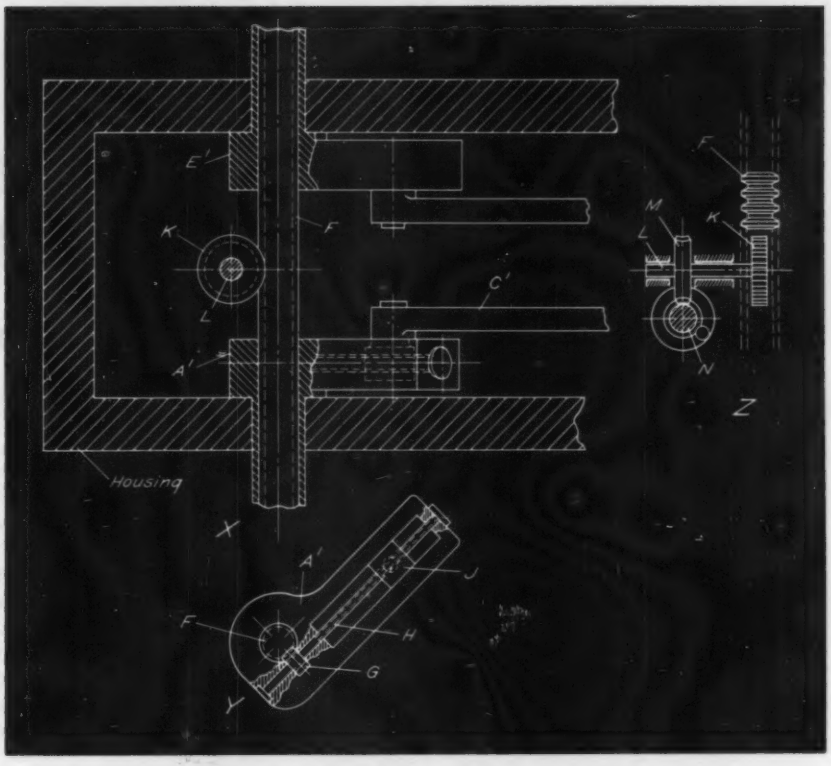


Fig. 2. Effective length of the crank may be altered during operation by means of a gear train.

to the end of coupler rod *C'*. The same arrangement is provided in the body of crank *E'*.

Cylindrical rack *F* is operated by the mechanism illustrated at Z. Gear wheel *K*, mounted on shaft *L*, meshes with the cylindrical rack. Also mounted on shaft *L* is a worm-wheel *M* that is driven by a worm *N*. An operating handle and a calibrated dial, both located outside of the crank housing, operate in conjunction with the worm.

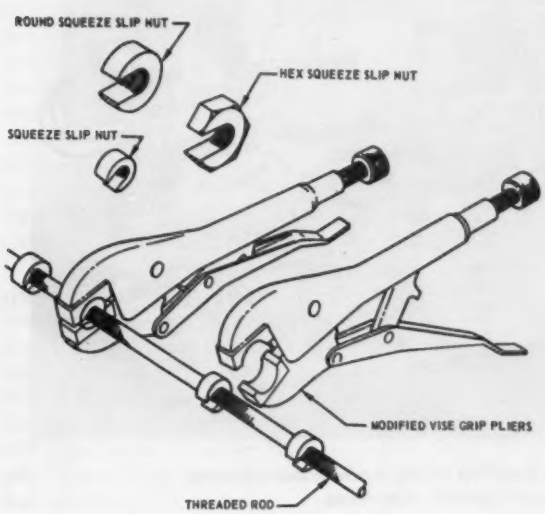
When the operating handle is rotated, gear wheel *K* is moved through the action of the worm and worm-wheel. This rotation of gear wheel *K* imparts a linear movement to cylindrical rack *F*. Pinion gear *G* and shaft *H* are then rotated, which, in turn, alters the position of coupler rod *C'*.

* * *

Slip-Squeeze Nuts Cut Costs at Convair

Slip-squeeze nuts developed at Convair (San Diego), a Division of General Dynamics Corporation, will save thousands of man-hours in the construction of plaster models and mock-ups. The new patented slip-squeeze nuts can be located immediately at any desired position on the rod, slipped into position, and squeezed tight in one easy operation. A special tool is advisable to install the nuts.

Slip-squeeze nuts can be produced with round, hexagonal, or any other shape periphery and various thread sizes, as seen in the accompanying drawing. Nuts which are used on rods having 1/4-20 threads are made with a 5/16-20 thread and a 1/4-inch slot. These are squeezed down to the required 1/4-20 thread size with special pliers, which can be made by reworking standard vise-grip pliers.



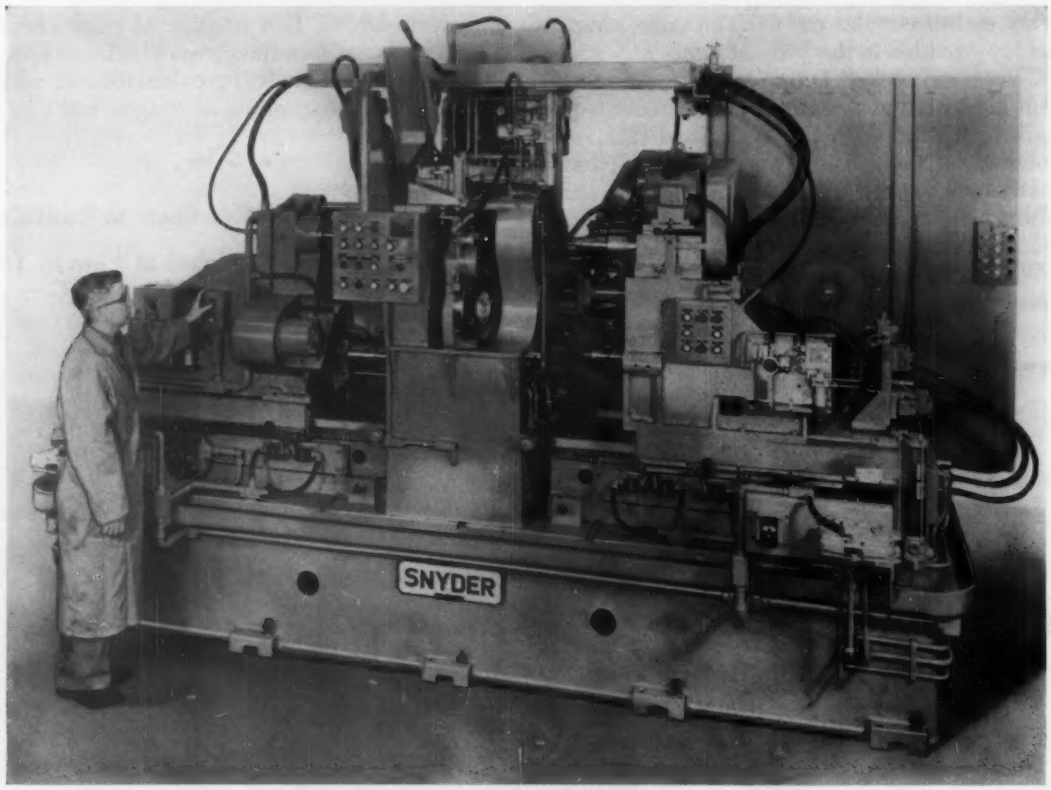
Slip-squeeze nuts are located at required positions on threaded rod and squeezed tight.

LATEST DEVELOPMENTS IN *Shop*

Snyder Trunnion Type Precision Boring and Automatic Bushing Assembling Machine

A six-station trunnion type, two-way, precision boring machine that performs both machining and automatic assembling operations on motor end shields has been built by the Snyder Tool & Engineering Co., Detroit, Mich. This machine has six precision boring spindles and utilizes a rotary hopper feed to guide split babbitt bushings to the fourth station for press-fit assembly. Deflection of the part during the assembling operation is prevented by a hydraulic stop that advances to within 0.002 inch of the back face of the part.

This equipment machines die-cast, electric motor end shields 5 11/16 inches in diameter and assembles a bushing in the center hole at a production rate of 350 pieces per hour at 75 per cent efficiency. An end shield is manually loaded into one of the fixtures in the horizontal trunnion type index unit and chucked. The fixture



Snyder six-station, trunnion type, two-way precision boring machine that performs both machining and automatic assembly operations

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

is then indexed and the machining cycle initiated by pressing a push-button.

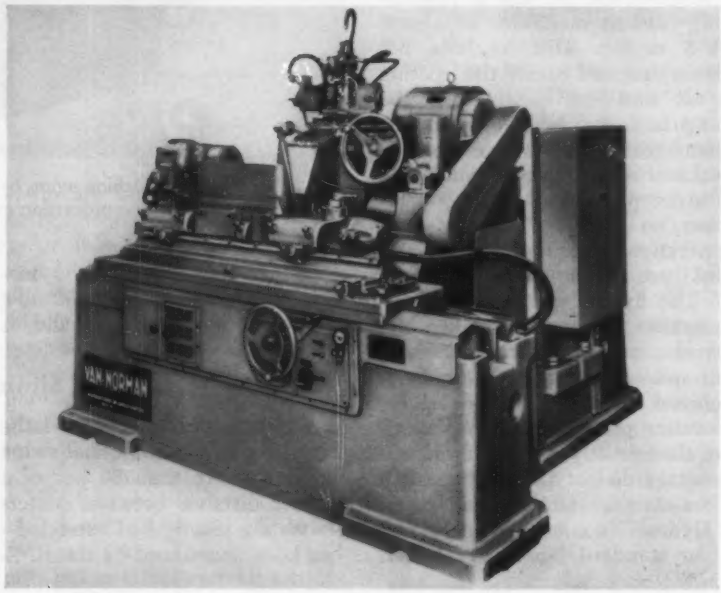
In the second station, precision boring spindles in each way unit advance to turn a groove on the outer left-hand hub, rough-face this hub, and rough-bore, rough-face, and chamfer the right-hand hub. At the third station, a 5/8-inch hole is bored in the hub and chamfered, the outside diameter is turned to size, and a step is faced with tools mounted in a single, heavy-duty, precision boring head.

The bushing is then assembled in the fourth station. At the fifth station, two precision boring spindles serve to face both ends of the hub and bushing. The left-hand side of the pressed-in bushing is chamfered in the sixth station, using a precision boring spindle.

All machining operations occur simultaneously with parts in the five machining stations. At each indexing movement, a part is unloaded from the first station and replaced by another part which is chucked before the cycle starting button is pressed. The machining cycle of this hydraulically operated, electrically controlled machine is entirely automatic.

The machine occupies a floor space about 8 by 14 feet and is 8 feet high. Air-oil mist lubrication is provided for the precision boring spindles, which are motor-driven through V-belt drives. Indicator lights located on the control panel serve to show the operating condition of each machining function.

Circle Item 101 on postcard, page 231



Bowgage production grinder brought out by the Van Norman Machine Co.

Van Norman Bowgage Production Grinder

The Van Norman Machine Co., Springfield, Mass., has announced a single-head plunge-cut Bowgage production grinder—4B61—which features the Bowgage wheel-head unit. This is a completely automatic integral grinding unit equipped for gaging, rough and finish feeding, automatic cycling, and rapid traversing.

By simply mounting the Bowgage wheel-head on a suitable base, work of practically any diameter and with tapers, shoulders, and other forms can be ground automatically to close tolerances. The operator simply loads the work-piece and pushes the starting button. The machine automatically performs all operations and then stops for removal and reloading of the work. It is available in two sizes—10 by 24 inches and 10 by 36 inches.

The maximum swing over the table is 10 inches; maximum diameter that can be ground, 6 inches; and the maximum distance between centers, 28 1/2 inches. Headstock speeds range from 50 to 600 R.P.M. with motors ranging from 1/2 to 1 1/2 H.P. Wheel-head spindle speed is 830 R.P.M. using a 7 1/2- to 10-H.P. motor. Grinding wheels 30 inches in diameter by 3/4 inch to 6 inches and 12 by 20 inches can be used. The

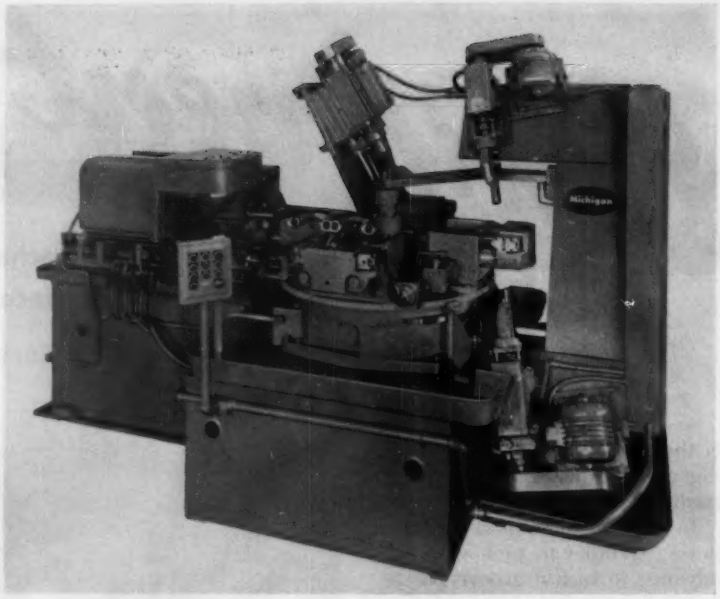
automatic wheel feed range is 0 to 0.063 inch. Rapid tranverse speeds range from 0 to 5 inches. Dwell or spark-out time is 0 to 5 minutes. Angular positioning of the wheel-head from 0 to 30 degrees is available. Net weight is about 19,400 pounds.

Circle Item 102 on postcard, page 231

Michigan "Angle-Matic" for Processing Manifolds

The Michigan Drill Head Co., Detroit, Mich., has brought out a special machine called the "Angle-Matic" for use in processing exhaust manifolds of a new V-8 engine. This machine has been designed to mill the locating pads and drill and ream the angular heat-tube holes in the exhaust manifold. It will process 120 exhaust manifolds per hour. With the exception of the milling operation on the locating pads, all operations performed on the manifold are of the angular type.

The fixture equipment on this machine serves to equalize the stock around the cored openings, in spite of the fact that no machined surfaces are available for locating purposes. The machine is of the five-way, angular and horizontal dial type featuring a four-station standard horizontal "Hydro-5" column assembly and four standard 9-inch stroke self-contained quill units. The machine is built to JIC hydraulic and electrical standards and is equipped with automatic lubrication throughout.

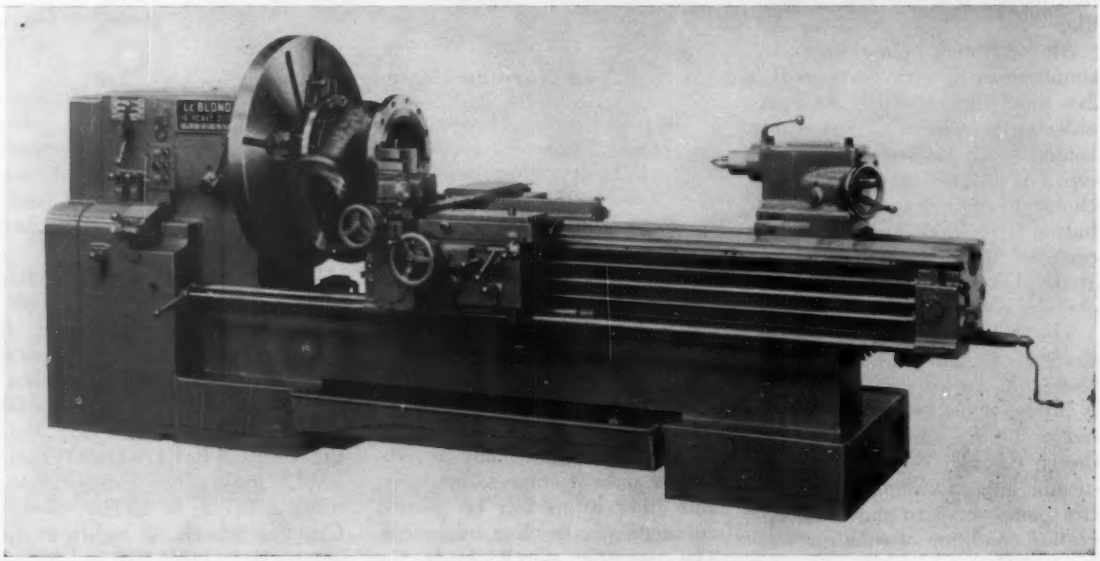


Special machine made by Michigan Drill Head Co. for processing exhaust manifolds

Circle Item 103 on postcard, page 231

LeBlond Sliding Bed Gap Lathe

A 16-inch sliding bed gap lathe that gives twice the normal swing size and more than 50 per cent greater distance between centers —with the sliding bed extended— has been announced by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. With the bed closed, this machine functions as a regular engine lathe. Its versatility makes it ideal for handling the unusual and often difficult



Sliding bed gap lathe announced by the R. K. LeBlond Machine Tool Co.

turning and facing work encountered in maintenance and job shop work, including large-diameter work, extra-long pieces, and parts with large projections.

The special bed, which slides open to form a gap, permits handling odd-shaped parts. For example, work 38 inches in diameter can be faced in one cut, and work 45 inches in diameter, in two cuts. Pieces more than 50 per cent longer than the normal center distance can be turned. With the extension rest (optional), work 27 1/2 inches in diameter by 13 1/4 inches in length can be turned. With the full-swing turning attachment (optional), parts 45 inches in diameter can be turned for nearly the full length of the gap.

Other important features of the lathe include new spindle bearing design for high-speed turning; combination gear-belt drive headstock; eighteen geared speeds and nine timing belt-driven speeds from 8 to 2000 R.P.M.; spur gear design; four-way rapid traverse; one-piece apron; totally enclosed quick-change box; hardened and ground steel bedways; and thrust-lock tailstock.

In addition to the 16/38-inch sliding bed gap lathe, LeBlond also has available 25/50-inch, 32/60-inch, and 17/28-inch Regal sliding bed gap lathes.

Circle Item 104 on postcard, page 231

Norton Universal Grinding Machines

With the addition of 14- and 18-inch, Type U-4, universal grinding machines, the Norton Co., Worcester, Mass., has completed redesigning its line of universal grinders. These two machines are said to assure fast setup and rapid action in performing external, internal, and angular grinding operations on large work-pieces.

In change-overs involving chucking, internal, or dead center grinding, setup is particularly fast. A chuck can be permanently mounted on the U-4 machines. A 6-inch D-1 cam lock nose on one end of the headstock takes chucks or special fixtures, and the other end is equipped with a dog driveplate for conventional grinding on centers. The change from conventional to chucking grinding only requires swiveling the headstock 180 degrees and chucking the work-piece.

The advantage of permanent chuck mounting combines with that of the hinged bracket type internal grinding spindle to speed setups for internal grinding. The individually powered internal spindle can be quickly swung down into the grinding position or it can be easily swung back to the inoperative position. Time-savings from these advantages plus those from the provision for doing internal and external grinding on a work-piece without disturbing the setup are said to assure consistently low job costs.

An infinitely adjustable work speed of 60 to 360 R.P.M. is produced by mechanical means from an alternating-current source. Ample power is provided throughout the entire work-speed range to permit handling a wide variety of grinding work. Speed changes are quickly made by a small handwheel on the head-stock.

The wheel-head has a double swivel, one above and one below the slide ways. This feature permits independent angular settings of the grinding wheel position and grinding wheel feed, thus making it possible to set the wheel at any angle and to feed at any angle—an important advantage in many special jobs.

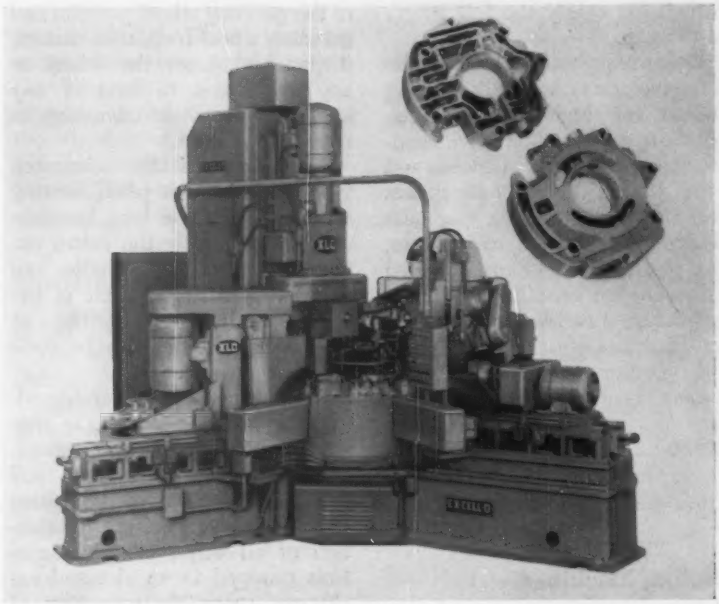
The automatically lubricated wheel-spindle is a plain bearing type in which the long bearings enclose practically the entire circumference of the spindle and support over 50 per cent of the spindle body. Heavy cutting, or the finest finishing, may be done with this spindle.

A combination lever-and-handwheel-operated footstock is supplied as standard. In lever operation, the footstock spindle will remain in the retracted position while loading. Pressure lubrication of all ways; electrical controls grouped in an elevated enclosure; accessible mounting of pumps and motors; and a ramped outlet in the coolant tank are additional features. The machines conform to JIC electrical and hydraulic standards.

An automatic grinding cycle arrangement and a power wheelhead positioning mechanism are available at extra cost. The Norton Swivalign dual electric indicator can be furnished with these machines for quick, accurate taper setting and for maintaining swivel table alignment within accurate limits when required.

Circle Item 105 on postcard, page 231

Internal grinding setup on the Norton 14-inch, Type U-4 universal grinder



Rearrangement of Ex-Cell-O units adapted this machine for production of redesigned automobile transmission part shown at upper right-hand corner

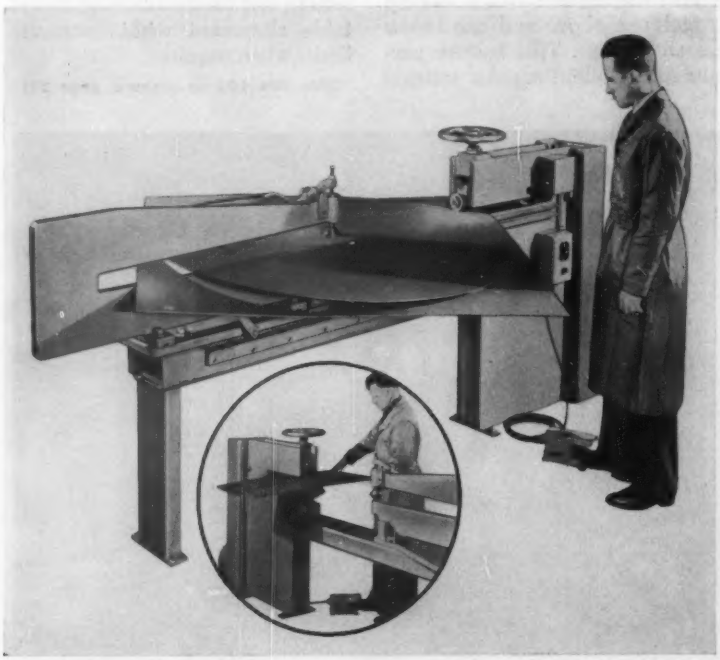
Special Machine for Processing Regulator-Valve Body

Special machines built by the Ex-Cell-O Corporation, Detroit, Mich., are often designed to facilitate changing the tool equipment and operating cycle to suit any possible changes in the work-piece. The Ex-Cell-O unit illustrated, for example, has been re-equipped to process a redesigned work-piece. While this involved no major alterations, certain changes in the tooling and operational cycle of the machine were necessary.

As rearranged for its new production job, this machine is equipped with a six-station rotary indexing table. Each station has two fixtures to permit reloading for operations on the reverse side of the part after the first side has been machined. A hydraulic cam-clamp holds the work-piece during the machining cycle.

The work-piece is an aluminum regulator-valve body for an automotive transmission. Machining includes: flycutting both flat sides; drilling and reaming two piston holes; drilling three angular holes; and drilling, reaming, and chamfering the top holes. Accurate flatness of the two sides is an important requirement. Net production rate is 120 parts per hour.

Circle Item 106 on postcard, page 231



Niagara shear for taking straight and circular cuts in steel sheets

Niagara Ring and Circle Shear

A No. 31-RC ring and circle shear, designed to cut commercially perfect circles in sheet steel, is being manufactured by the Niagara Machine & Tool Works, Buffalo, N. Y. This shear has a self-compensating circle arm which floats on guided ways to maintain the true center automatically. Thus the time-consuming adjustments for variations in thickness of material, overlap of cutters, and diameter of circle are eliminated. A scale facilitates positioning of the circle arm for cutting various diameters, and the center clamp is adjustable to hold varying thicknesses of material.

The shear can be used for cutting both straight line work and irregular outlines (not requiring sharp curvatures), as well as for cutting circles, circular holes, and rings. It will cut circles from 6 through 78 inches in diameter in 10-gage mild steel. The upper cutter can be raised and lowered by means of a handwheel, which permits starting the cutting operation at any point on the blank.

The high-carbon, high-chromium steel cutters are designed to assure clean, fast cuts. Both an adjustable swinging gage for centering unmarked blanks and

an adjustable straight slitting gage are furnished as standard equipment.

Circle Item 107 on postcard, page 231

"Trippit" Automatic Control for Power Presses

An electric master control called the "Trippit," designed to bring automation-like efficiency to the operation of power presses, shears, and brakes, is available from the General Automation Corporation, Yonkers, N. Y. This equipment has been developed to eliminate much of the operator's work and permit him to perform his tasks with less fatigue and greater safety. It also serves to increase production, eliminate rejects, and reduce down time caused by jamming.

For hand-fed and secondary operations, the work-piece trips the press automatically. The press will not operate until the piece is properly and accurately nested. A second stroke cannot be obtained until the piece is removed and another blank inserted. Gaging is automatic, and the point of operation can be guarded completely.

Counters are available for operation on 110 and 24 volts. Bell wire to the 24-volt counter socket can be run from each machine to a centralized counter control panel for supervisory purposes.

Circle Item 108 on postcard, page 231

Birdsboro Giant-Size Extrusion Press

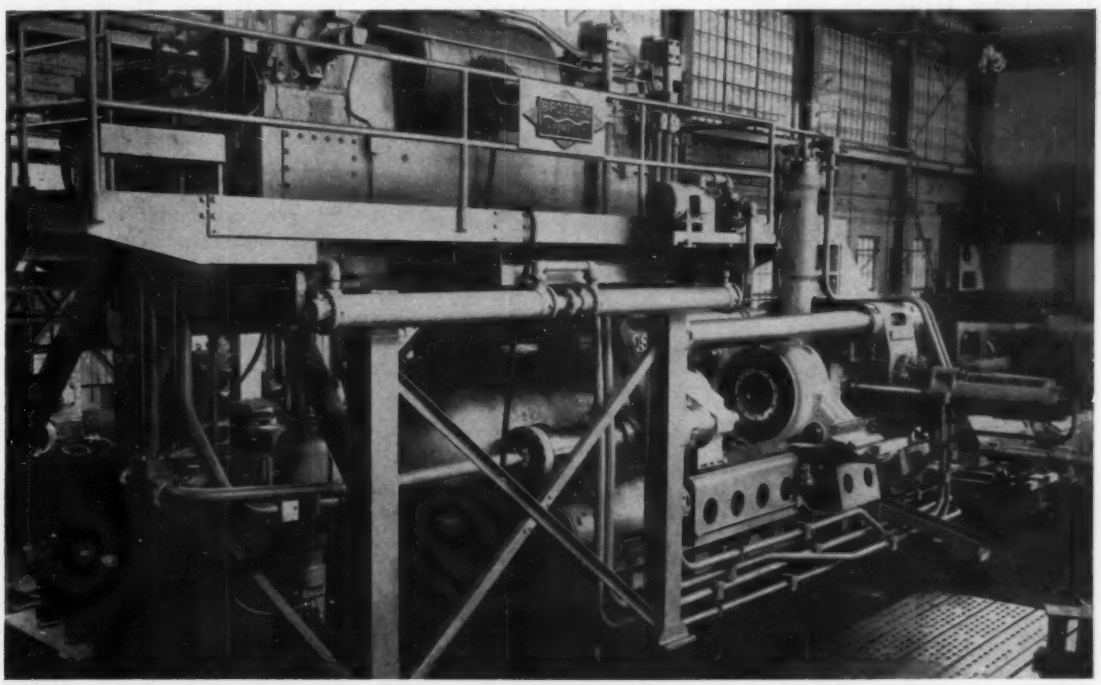
The Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., has built for the Kaiser Aluminum & Chemical Corporation, Halethorpe, Md., the first of three huge 2750-ton extrusion presses. This four-column, self-contained, oil-hydraulic press has been designed for safe, rapid, and efficient extrusion of aluminum and aluminum alloy billets. Five railroad cars were required to transport the press, which will weigh about 380,000 pounds when fully installed. The over-all length of this machine is approximately 34 feet 6 inches, and the height over the vertical shear is 14 feet 8 inches.

The press is designed to make extrusions from billets 8 to 12 inches in diameter and up to 32 inches in length. It can also be equipped to extrude billets from a rectangular container 4 by 16 inches. A special die-slide allows extrusion to proceed through one die while a second die stack is inserted, removed, or dressed.

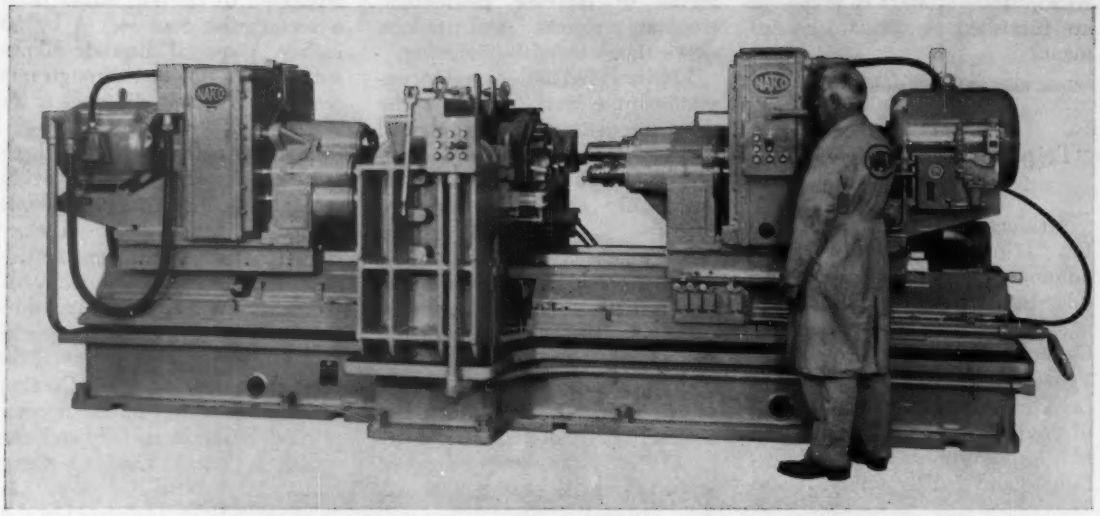
The hydraulic system has three large Oilgear pumps. Two provide constant delivery of 108 gallons per minute and one is an electronically controlled, variable delivery pump with a capacity of 108 gallons per minute. An additional pump and motor are used to seal the container at 3000 pounds per square inch. Cooling of the hydraulic oil is accomplished by large coolers and the circulating pump. The main pump motors total 550 H.P.

The rapid advance speed of the main ram is 626 inches per minute, and the extrusion speed is variable without steps up to 37.5 inches per minute. Ram return speed is at the rate of 342 inches per minute. Other speeds in inches per minute are as follows: billet loader, 567; container stripping, 416; container sealing, 362; butt shear, 745; and auxiliary shear, 667. The estimated "dead cycle" time is twenty-three seconds.

Circle Item 109 on postcard, page 231



Aluminum and aluminum alloy extrusion press built by the Birdsboro Steel Foundry & Machine Co.



Natco two-way horizontal boring machine equipped to machine five different transmission housings

Natco Two-Way Automatic Boring Machine

Transmission housings are being machined automatically and to very close tolerances at a production rate of 35 per hour on a two-way automatic boring machine built by the National Automatic Tool Company, Inc., Richmond, Ind., for the Frank G. Hough Co., Libertyville, Ill. The tolerance on the idler bore of the transmission housing is held to the specified tolerance of 0.0005 inch and square with the mounting face within 0.0005 inch per inch of bore length. The boring machine is equipped with hydraulic feed and has a fixture designed to hold five different transmission housings. In addition to close-tolerance boring, the machine also chamfers, counterbores, and notches boss contours.

Circle Item 110 on postcard, page 231

Hydraulic Feeds for Production Machines

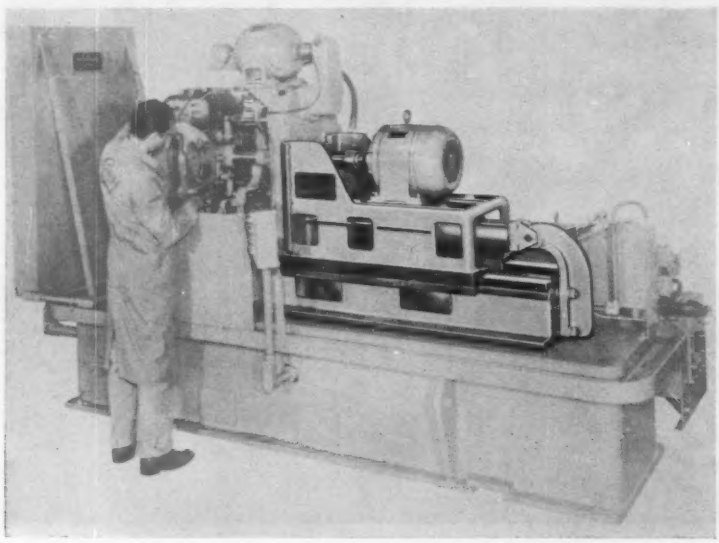
A line of standard horizontal and vertical way type hydraulic feed units, designated Series 20-400 and 20-401, has recently been brought out by the Hartford Special Machinery Co., Hartford, Conn., as another item in its line of components for "Build-Your-Own" production machines.

These standardized components, featuring "balanced thrust," are designed to provide thrust above the ways near the tool-loading area. They allow positive control of rapid traverse, fine feed, and depth. Depth of feed will be held within 0.0005 inch. The flange is designed to simplify mounting and aligning of multiple-spindle heads, and the 15-inch stroke assures ample clearance for tool-changing.

In its position above the ways, the power cylinder is more accessible for maintenance, and the hydraulic control panel can be mounted on either side of the unit. A separate floor type power pack supplies the hydraulic power in full compliance with JIC standards.

The feed rate is infinitely variable from 0 to 24 inches per minute, rapid advance is 8 inches per second, and rapid return is at the rate of 5 inches per second. Rapid-advance and feed-stroke lengths are adjustable to suit, by repositioning control dogs. Multiple-spindle drive motors up to 20 H.P. can be mounted on the saddle. Precision hardened and ground ways are standard equipment.

Circle Item 111 on postcard, page 231



Machine equipped with Hartford hydraulic feed unit

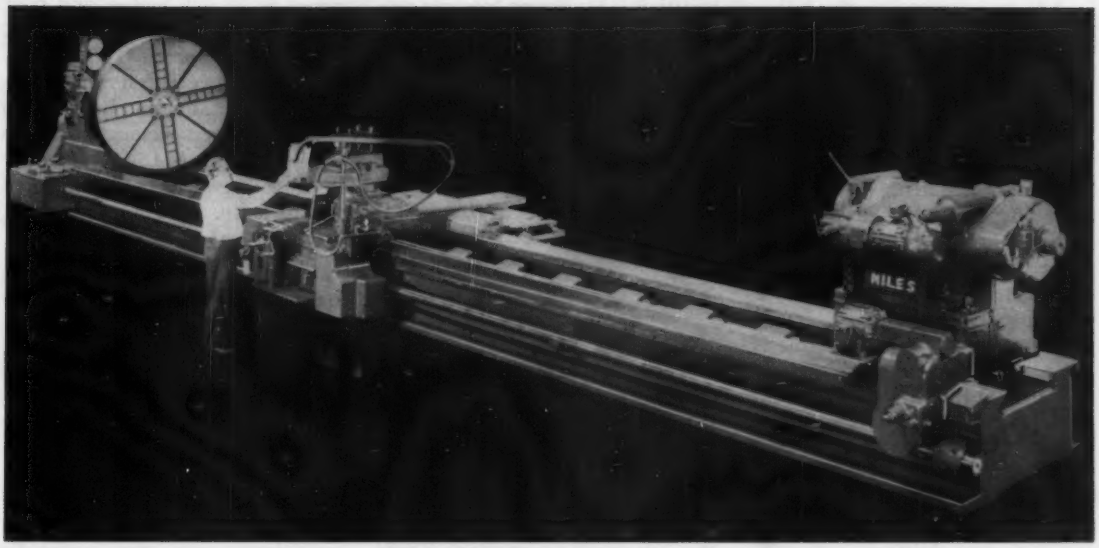


Fig. 1. Niles engine lathe built by Baldwin-Lima-Hamilton Corporation

Niles Heavy-Duty Engine Lathe

A Model 72-A Niles heavy-duty engine lathe is now being built by the Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio. Features incorporated in this lathe include: speed and load indicators on the faceplate drive; load indicator on the adjustable, spring-loaded tailstock quill; fully enclosed lead-screw speed and thread selector dial; hydraulic booster on the faceplate speed changer; lubrication oil-pressure protection; and optional electronic feed control.

The speed and load indicators on the headstock enable the operator to keep a close check on machine performance and assist him in loading it to capacity without danger of applying excessive overloads. The load indicator on the tailstock quill obviates guesswork when preloading the quill spring to suit the work-piece, thereby saving time in setting up work and preventing damage to centers.

The faceplate hydraulic speed-changer booster eliminates the heavy manual labor normally required to change speeds on large conventional lathes, and the oil-pressure protection prevents operation of the machine unless positive lubrication is applied. Whether electronic or mechanical

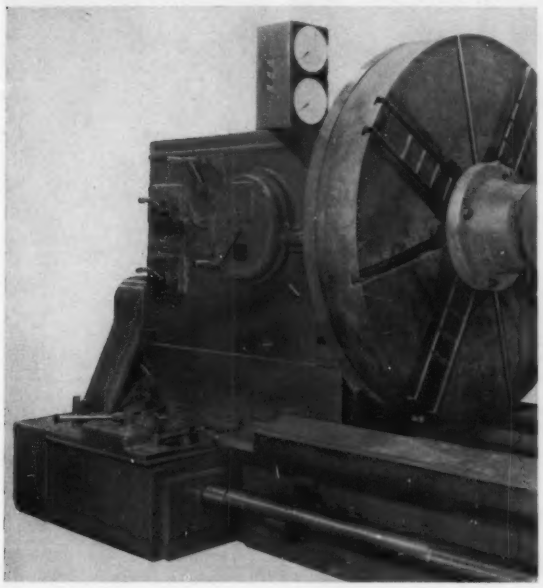


Fig. 2. Close-up view of headstock and faceplate of lathe shown in Fig. 1

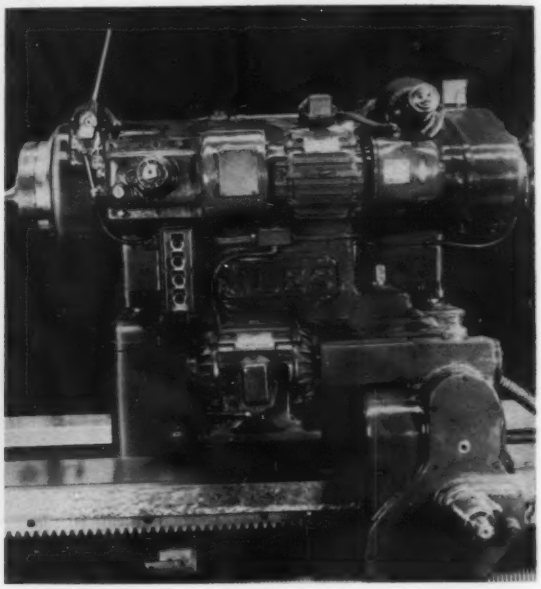


Fig. 3. Antifriction live center tailstock with power traverse used on Niles lathe, Fig. 1

feed is incorporated in the lathe, the operator has complete control at the carriage station through a push-button panel. Safety interlocks prevent simultaneous engagement of electronic and mechanical feeds. Lathes with electronic equipment for feeding and threading can also be provided with mechanical feeds. One lever serves to select either mechanical or electronic feeds. Sixty-four feeds are available.

The main drive for the lathe is by a 100-H.P., adjustable-speed 400 to 1600 R.P.M., direct-current motor, but variable-voltage drive can be substituted to meet customer specifications. Mounted on the headstock are jog buttons for forward and reverse rotation to facilitate gear shifting.

The faceplate, with adjustable-speed, direct-current drive, has three mechanical speed ranges: through the faceplate drive, 1.35 to 5.4 and 5.48 to 21.9 R.P.M.; and through the spindle drive, 25.2 to 101 R.P.M. Power traverse motions, independent of main feeds and spindle, are obtained by a separate 5-H.P. motor mounted on the carriage apron and operating through a safety friction clutch. Thus, traverse can be obtained with or without rotating the work part.

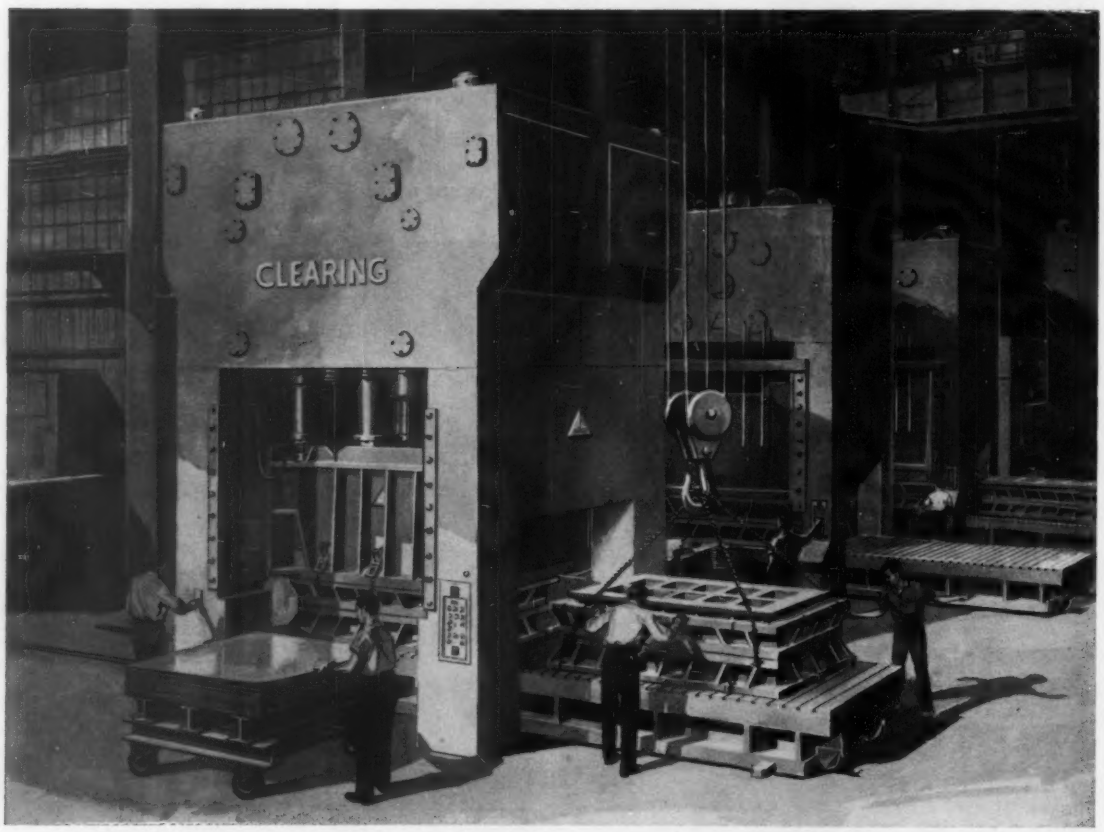
Swing over bed and carriage wings is 73 1/2 inches and over carriage bridge, it is 56 inches. Faceplate diameter is 72 inches. Distance between centers is nominally 46 feet, but can be made to suit customer specifications. The over-all length is 13 feet plus the distance between centers specified for the lathe.

Circle Item 112 on postcard, page 231

Clearing Press Equipped for Quick Die Changing and Setting

A Clearing press of unusual design, developed to eliminate major production delays in changing dies, has been announced by U. S. Industries, Inc., Chicago, Ill. This press is equipped with a double-size bolster which moves on tracks through the die space area. There is always one bolster located outside the press on which the next dies to be used can be set up while the machine is operating.

When a press run is completed, the operator simply presses a button which causes the die punch to be automatically unclamped. The slide is then raised to provide clearance, and the outboard bolster with its preset dies is moved under the slide into the press bed area. Next, the slide adjustment is run down, and the automatic clamps instantly lock the new die punch to the slide. Thus, the new job is started in just minutes after the previous one is completed. The bolster is controlled electrically and is moved by power into



Clearing press with quick-change die clamps announced by U. S. Industries, Inc.

position, where it is locked solidly in place.

Hydraulically operated quick-change clamps facilitate detaching old dies and clamping new ones. These clamps are installed on the press slide as shown in the illustration. The number used depends upon the size of the press.

"Push-button" die-setting, made possible by this type of Clearing press, is said to materially reduce down time in plants where large press equipment is used for comparatively short runs. This die-setting feature is available on all Clearing presses, including single- and double-action, as well as top drive and bottom drive types.

Circle Item 113 on postcard, page 231

Low-Alloy Automatic Welding Wire

A chrome-nickel-molybdenum alloy automatic welding wire with less than 2 per cent total alloy content—designated A-S-8620—is announced by American Chain & Cable Co., Inc., Bridgeport, Conn. This wire has a standard AISI low alloy content. If the base metal has a higher carbon content, the carbon pick-up from dilution in the weld metal gives excellent wear resistance and high elongation qualities to prevent cracking and spalling.

In its application, as worked out by the Page Steel & Wire Division, American Chain & Cable Co., Inc., Monessen, Pa., the welding wire is particularly well suited for welding U. S. Steel's T-1 steel, an alloy with very high physical properties—tensile strength from 105 to 130,000 pounds per square inch; elongation 15 to 20 per cent; and Rockwell hardness of C20 to C35.

With the proper flux (submerged arc) on T-1 steel, the welding wire gives a tensile strength of 114 to 116,000 pounds per square inch; elongation of 12 to 15 per cent; and a Rockwell hardness of C28 to C30. The chemical analysis, as welded, is very close in all elements to the parent T-1 steel. Face and root bends show 100 per cent efficiency, and there is no "affected" zone.

Circle Item 114 on postcard, page 231

Henry & Wright Double-Crank Automatic Dieing Machine

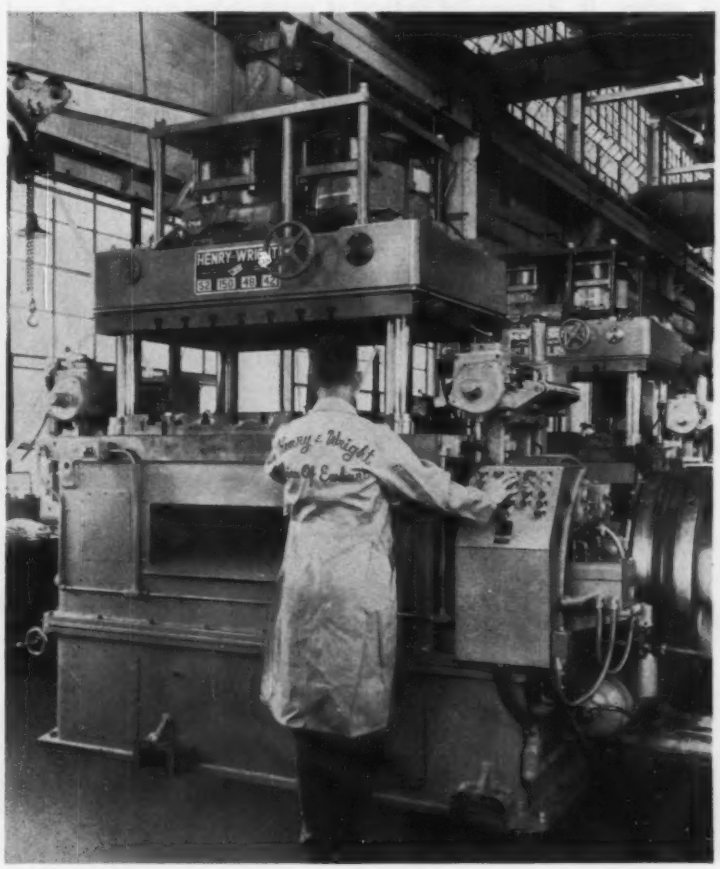
A line of automatic double-crank dieing machines developed to extend the economies of high-speed methods of metal-forming to a broader range of parts and products has been introduced by Henry & Wright, Division of Emhart Mfg. Co., Hartford, Conn. These machines are designed to produce large-size stampings requiring large bed areas but not necessarily heavy tonnage capacities. At the same time, they provide adequate strength for turning out parts by progressive stamping methods when eccentric loading demands extra rigidity.

Ten of these new S-2 series, 150-ton units, designed to meet JIC specifications, are now in production, and a special 350-ton machine has also been built. These S-2 models can be built in capacities from 25 to 500 tons.

Machines equipped with progressive dies make it possible to combine complex stamping and forming operations into one progressive production sequence. Coil or sheet metal is fed through roll feeds to a series of die stations where piercing, blanking, forming, and other operations are accomplished with each stroke. After the first part is ejected, each stroke of the machine produces a finished product.

In the double-crank machine, pressure is applied by two crankshaft connections located in the base to provide a more even distribution of force over a longer bed area. A rigid, welded steel frame, stress-relieved to maintain accuracy, is completely enclosed to prevent chips, slugs, stock lubricating compound, and other foreign matter from entering and damaging working parts.

Circle Item 115 on postcard, page 231



Double-crank automatic dieing machine of 150-ton capacity developed by Henry & Wright, Division of Emhart Mfg. Co.

Morton Special Heavy-Duty Grinding Machine

A special heavy-duty machine for grinding long members has been built by the Morton Mfg. Co., Muskegon Heights, Mich. This machine will grind either straight surfaces or long-curve irregular surfaces, as determined by the template in use.

The machine is basically a traveling-wheel type on which the work remains stationary. A rugged compound saddle is mounted on the bed and is traversed longitudinally by means of a heavy-duty roller type chain, which is driven through a suitable sprocket and worm reduction unit by a variable-voltage or reversing motor. This drive gives a very smooth flow of power in varying speeds up to 100 feet per minute.

The compound saddle permits the grinding column, on which the vertically movable spindle is mounted, to be moved toward or away from the work a distance of 24 inches. It is provided with automatic "in" and "out" cross-feed and also with automatic vertical adjustment of the spindle. The saddle on which the spindle is mounted can be moved vertically on a column to provide approximately 48 inches of vertical travel. The spindle can rotate in the vertical plane and is arranged so that grinding can be performed either on the periphery of the wheel or by cup grinding. The drive to the spindle is by a 30-H.P. motor operating at 1200 R.P.M.

The design of this machine permits any length of bed to be used. The one illustrated is 30 feet long with 22 feet of working travel. Provisions are made in a permanent installation for tying the work-table and the base together to simplify incorporating a suitable coolant collection and return system in the foundation.

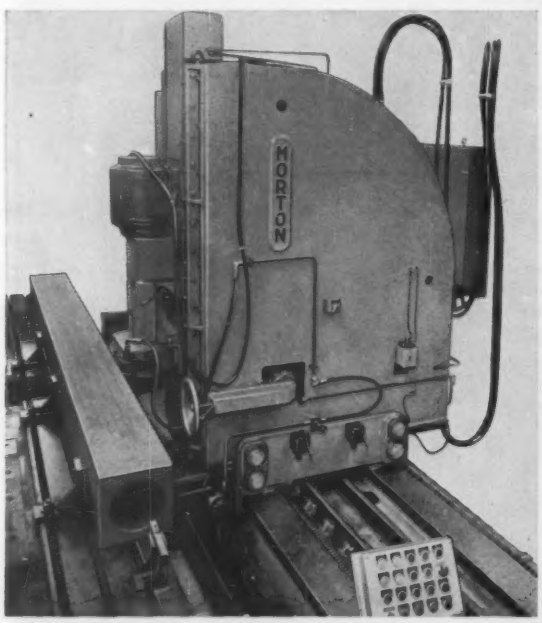
Circle Item 116 on postcard, page 231

Hand Mills Equipped with Air-Hydraulic Feed and Two-Spindle Head

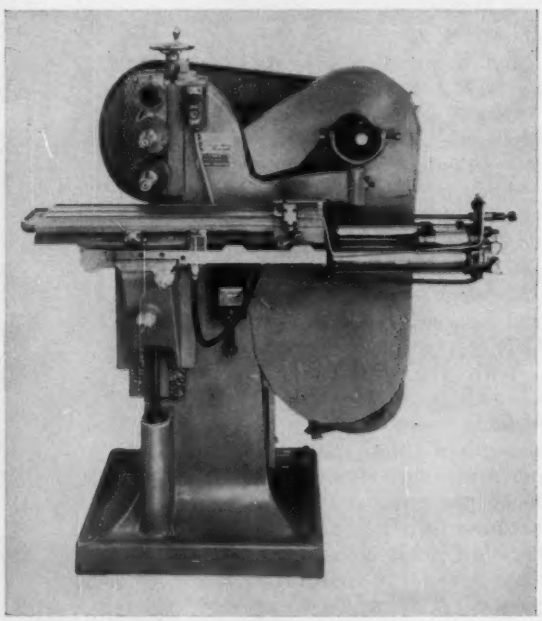
An air-hydraulic feed has been developed for use on hand mills made by the U. S. Burke Machine Tool Division, Cincinnati, Ohio. This feed, combined with a two-spindle head, is said to double the production capacity of the hand mills. A mill equipped with a 12-inch "skip-stroke" air-hydraulic table feed and two-spindle heads functions as follows: automatic table feed at rapid approach; feed at controlled cutting speed and distance; second rapid approach; second controlled cutting operation; and automatic rapid return.

Two vises or other work-holding fixtures can be mounted on the table for milling two or more work-pieces during each complete pass. The two-spindle head can also be adapted to U. S. Burke hand or power table feed millers. The lower spindle is mounted in a fixed position and the upper spindle can be raised or lowered to handle various sizes and types of work-pieces and to compensate for cutter wear.

The lower spindle is driven by V-belt from the backshaft pulley and the upper spindle is driven through a gear train from the lower spindle. The spindles rotate in opposite directions to permit conventional milling from both positions. The new automatic table feeding device and dual spindle arrangement, singly



Special heavy-duty machine for grinding long work built by the Morton Mfg. Co.



U. S. Burke hand mill equipped with air-hydraulic feed and two-spindle head

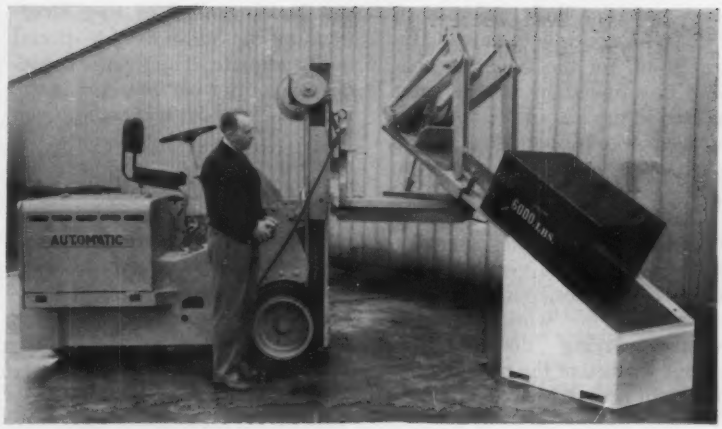
or in combination, serve to increase the flexibility of the new hand mills.

Circle Item 117 on postcard, page 231

Attachment for Loading and Removing Dies from Inclined Presses

A truck attachment for loading and removing dies from inclined presses has been brought out by the Automatic Transportation Co., Division of the Yale & Towne Mfg. Co., Chicago, Ill. The table of this attachment can be rotated 180 degrees horizontally, permitting dies to be loaded and unloaded from any angle. This means that the truck upon which the die handler is mounted need not be in a direct line with the press or at right angles to it, thus giving the truck better maneuverability. The table of the attachment, besides its horizontal rotation, tilts, permitting the operator to position and retrieve dies in die presses inclined up to 45 degrees.

The illustration shows the die-handling attachment mounted on the company's Model LFS-90 heavy-duty electrically driven industrial truck. The attachment can handle dies weighing up to 6000 pounds, is operated by the truck's hydraulic system, and is controlled by a portable push-button panel. It can be mounted or dismounted very quickly by disconnecting two hydraulic lines and removing two bolts.



Heavy-duty electric truck and attachment built by Automatic Transportation Co. for loading and removing dies from press

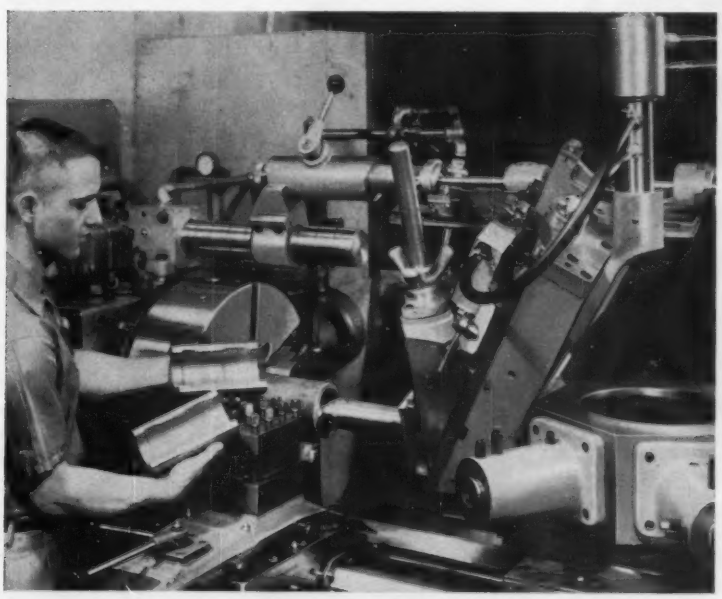
Circle Item 118 on postcard, page 231

Warner & Swasey Contouring Slide-Tool Attachment for Saddle Type Turret Lathes

A hydraulically controlled slide-tool attachment, designed for fast, accurate internal contour-boring of complex shapes as well as large diameter contour-turning, is announced by the Warner & Swasey Co., Cleveland, Ohio. This attachment, engineered for application to the company's 3-A and 4-A heavy-duty saddle type turret lathes, is mounted at a 60-degree angle to the spindle center line on one of the faces of the hexagon turret. The complete tool, with template-holder and template attached, indexes with the turret, thus eliminating any interference with other tooling located on adjacent turret faces.

Contours involving curves, tapers, radii, and even square shoulders can be machined quickly and accurately through the use of this attachment, employing only simple, inexpensive tooling. In addition, low setup time enables both small- and large-lot production to be handled economically.

Actuation of the tracer-slide is by means of a large, direct-acting hydraulic cylinder. The long piston stroke of this cylinder provides an effective cutter travel of 4 inches, thus permitting the machining of contours having variations in diameter of as much as 8 inches. Extremely sensitive tracer-slide response is obtained from a differential pressure, closed-circuit hydraulic system regulated



Hydraulically controlled contouring slide-tool attachment, introduced by Warner & Swasey, shown mounted on the turret of a 3-A saddle type lathe. Operator holds longitudinally sectioned work-piece revealing typical internal contour machined with this attachment

by a precision-built, microsensitive stylus-controlled valve. Hydraulic oil for the tracer mechanism is supplied by another unit located at the rear of the machine. A full-flow multiple filter system of over-size capacity insures an ample supply of clean, cool oil.

The micrometer-adjusted tool-holding block provides precision adjustments over a vertical range of 10 1/4 inches, permitting the contouring of work-pieces of widely varying diameters. A unique feature of the new contour slide-tool is that its tracing action can be controlled in two directions by the addition of a special dual template. Thus, with a special two-cutter bar mounted in the tool-holder, an optional setup can be provided which will allow the attachment to contour-bore both "in" and "out." This permits completion of all surfaces in a complex bore in one setup. The unit offers high accuracy, fast setup, and easy operation without sacrificing the inherent versatility of the turret lathe on which it is used.

Circle Item 119 on postcard, page 231

Swivel and Air Counterbalance Attachment for Multiple-Spindle Heads

A combination swivel and air counterbalance attachment that permits use of large multiple-spindle drill and tapping heads on radial drilling machines has been developed by the U. S. Drill Head Co., Cincinnati, Ohio.

Two cylinders maintain a balanced condition of the head on the machine. The air used for counterbalancing is controlled at both ends of the stroke. Therefore, only sufficient pressure is maintained to counterbalance the weight of the head during all portions of the stroke. On the return stroke, the air is controlled to prevent extreme, quick return of the head, which, if not controlled, could endanger the operator. With this attachment are furnished an air filter, a pressure regulator, and an air oiler.

The special radial drill mounting attachment incorporates a 360-degree swivel feature. This facilitates proper alignment of the entire drill head. The fixed center type head, as well as the adjustable type head, operates equally well with this counterbalance attachment. This equipment is especially adapted for use in drilling condenser plates, boiler tube sheets, and flue sheets.

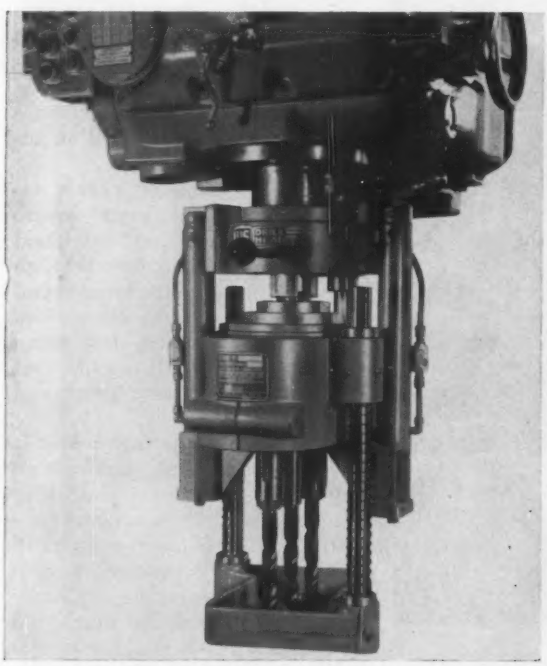
Circle Item 120 on postcard, page 231

Elmes Die-Casting Press

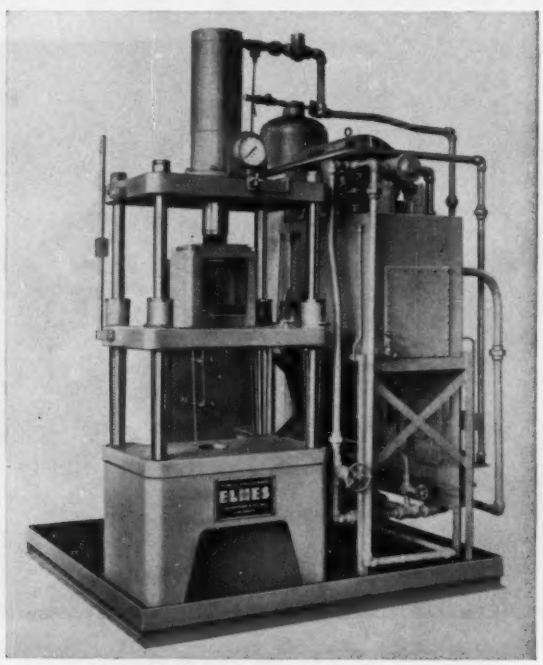
An Elmes hydraulic die-casting press developed to meet special production requirements has been announced by the American Steel Foundries, Elmes Engineering Division, Cincinnati, Ohio. This press is an accumulator-operated unit designed for casting aluminum motor rotors. The entire machine is an integral "package" unit consisting of press, accumulator, pump, valve subplate, and control panel—all mounted on a common, one-piece baseplate.

The hydraulic circuit is designed for push-button operation with the use of a fire-resistant fluid. Using the customer's tooling, the operator simply ladles in the molten aluminum and closes the safety door which initiates the press cycle. Both loading and unloading are automatic.

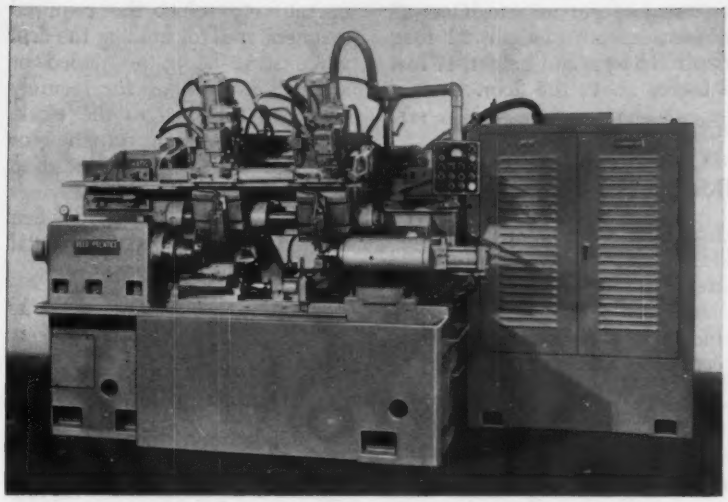
Circle Item 121 on postcard, page 231



Air balancing attachment for drilling and tapping heads developed by U. S. Drill Head Co.



Hydraulic die-casting press announced by American Steel Foundries, Elmes Engineering Division



"Reedmatic" production lathe developed by Reed-Prentice Corporation

"Reedmatic" Production Lathe

An automatic production lathe, known as the "Reedmatic," is being offered to the metalworking industry by the Reed-Prentice Corporation, Worcester, Mass., subsidiary of the Package Machinery Co. This machine is available in several sizes and with various combinations of mechanical feeding or hydraulic tracer-slides.

There are two models. The C-30 machine has an 18-inch swing over the carriage ways and a 12-inch swing over the cross-slide ways—maximum input 30 H.P. The swing over the carriage ways of the C-60 model is 24 inches and 16 inches over the cross-slide ways—maximum input 60 H.P. Both models can be arranged for chucking or between-center work. Quadruple pick-off gears provide an unusually wide range of spindle speeds.

A dry disc type clutch and brake are mounted on the main shaft. The clutch is hydraulically operated and protects the machine against overloads. The headstock is automatically provided with lubricant as the spindle is set in motion. Either mechanical or hydraulic feeds are available for the turning and facing slides. The tracer is mounted 90 degrees from center line of spindle and permits mounting multiple tracing slides to operate independently or simultaneously. The tracer-controlled slide can also be fed transversely as well as longitudinally. Thus, with a continuous cycle, fillets can be generated and shoulders faced with extreme accuracy.

Micro control provides accurate adjustments for size control without disturbing the cutting tool. Micrometer adjustment is also provided for both diameter and lateral size control. The multi-cycle control automatically positions the tool-slides for any predetermined number of cycles, thus making it possible to rough, semi-finish, and finish the work-piece without removing the part from the machine.

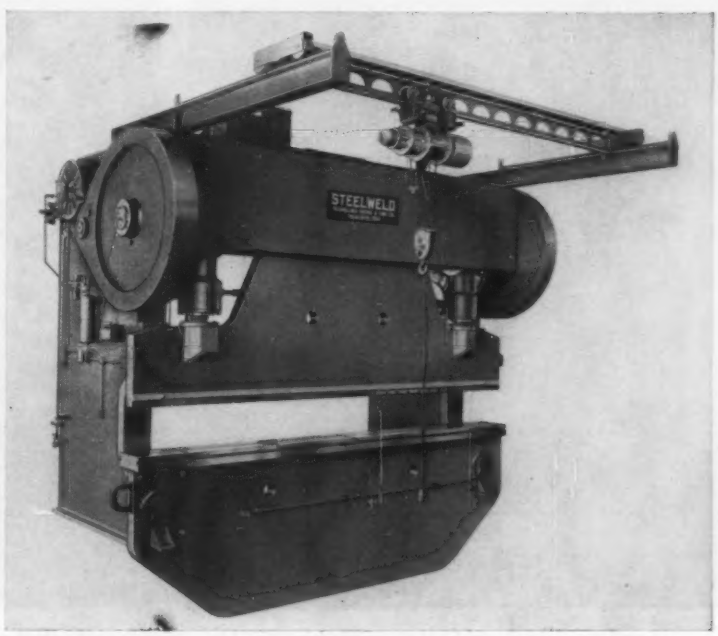
The tailstock is hydraulically operated with pressure control. Close-fitting, long-wearing molded plastic bearings eliminate side play and scoring of the hardened and ground quill.

Circle Item 122 on postcard, page 231

Work-Handling Crane for Press Brake

Built-in, overhead crane equipment for handling heavy steel plates is now available on Steelweld press brakes made by the Cleveland Crane & Engineering Co., Wickliffe, Ohio. The press brake illustrated has a 3-ton, hand-propelled crane with electric hoist made by the Cleveland Tramrail Division of the company. The crane is 18 feet long and can be traveled as far as 8 feet to the front of the bed center.

This brake is so large that it is necessary—because of shipping limitations—to provide a detachable bed, which is secured to the machine by resting it on saddles at each end and bolting to the



Steelweld press brake with built-in work-handling crane

frame. The machine has a rated capacity for handling mild steel 20 feet by 5/8 inch and will take 16-foot plates between housings. It has two speeds—seven or twenty-one strokes per minute. Over-all dimensions are: length, 22 feet; depth, 11 feet; and height, 17 feet 2 inches above the floor.

Circle Item 123 on postcard, page 231

J & L Small-Size Boring Machine

The Jones & Lamson Machine Co., Springfield, Vt., has announced that its Thread Tool Division will produce a small precision boring machine developed by Mecanair, Inc., Sudbury, Mass., from whom J & L recently acquired all manufacturing and selling rights. This machine is intended primarily for boring small holes in instrument parts and housings and is capable of holding very close tolerances. It is a compact, versatile unit designed mainly for small-lot production, and can be easily adapted to new jobs.

The work-table is operated by an air cylinder and hydraulic check unit which can be adjusted for varying amounts of feed. A cross-slide can be attached to the work-table for facing in the same cycle in which the boring operation is performed. An additional head may be attached to permit dual boring operations. The machine is especially well suited for use in the small instrument and electronics fields and in the production of carburetor and fuel injection equipment.

Circle Item 124 on postcard, page 231

Bux Magnetic Drill Press

An improved, portable drill press with variable magnetic power control, developed for rapid hole-drilling, tapping, and reaming, has been announced by the Buck Mfg. Co., Los Gatos, Calif. This unit, called the Bux magnetic drill press Model V-3, has a rheostat control switch for selecting the proper magnetic pull to suit each particular job; a pilot-light assembly that floods the drill point area with light; and a compact rectifier unit for converting alternating to direct current.

The rheostat switch permits the operator to select the required magnetic pull for holding the drill while it is being positioned or aligned, as well as for securely clamping the drill to the work-piece while drilling, tapping, or reaming. This control is said to make possible substantial savings in setup time, particularly when drilling in awkward horizontal and overhead positions.

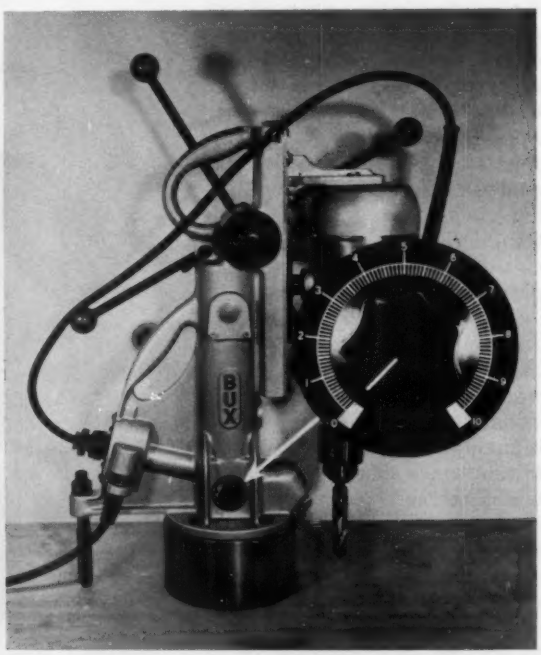
Circle Item 125 on postcard, page 231

General Electric Shaded-Pole Motor

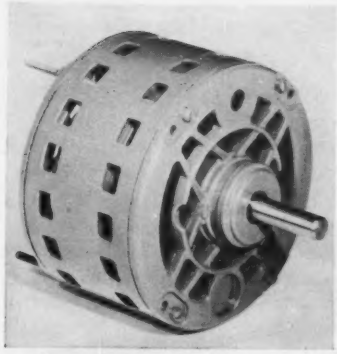
A shaded-pole motor that reverses positively at high speeds without a capacitor and with low reversing current has been developed by the Specialty Component Motor Department of the General Electric Co., Schenectady, N. Y. Available in 1/15- through 1/8-H.P. ratings with single and dual speeds, this 5 1/2-inch diameter motor is suited for use in window ventilators, evaporative coolers, exhaust and circulating fans, and similar air-moving devices with moderate radial and axial thrust loads.

Simple switch control makes it unnecessary to halt the fan motor

Small-size boring machine announced by the Jones & Lamson Machine Co.



Portable magnetic drill press brought out by the Buck Mfg. Co.



Shaded-pole motor developed by General Electric Co.

to reverse direction at high speed. The 1/8-H.P. size with an efficient blade can deliver in excess of 3500 cubic feet of air per minute. High dip torque is said to make possible dependable multi-speed operation and speed stability over a wide range. Sealed lubrication and oil grooves in the shaft conduct filtered and cooled oil to bearing surfaces. A special resin treatment permeates the windings and protects the stator from moisture and acids. Weighing between 9 and 10 pounds, depending upon the rating, the motor can be mounted with through-bolt construction with shaft-end or opposite shaft-end connection. Other types of mountings are available.

Circle Item 126 on postcard, page 231

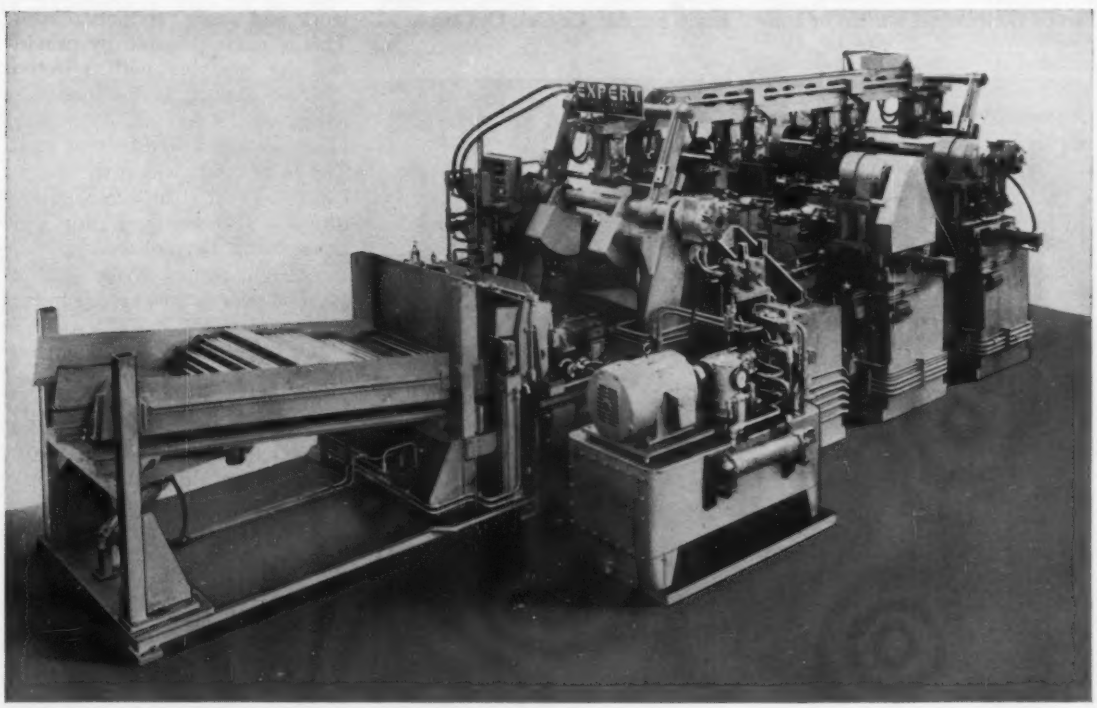
Automated Machine for Flaring, Facing, and Chamfering Ends of Tubes

An automated, five-station, in-line, transfer type, double-end precision boring machine, utilizing modular construction, a unique inclined hopper-feed mechanism, and an overhead transfer-bar arrangement, has been designed and built by the Expert Automation Machine Co., Detroit, Mich. This machine flares, faces, chamfers, and rough- and finish-bores both ends of various lengths of tubular steel automotive steering columns at the rate of 414 tubes per hour at 80 per cent efficiency.

The machining heads and the hopper feed can be adjusted to handle tubes 32, 33, and 34 inches long, having a diameter of 1 1/2 inches. The tubes are transferred in pairs by the counterweighted overhead oscillating transfer-bar mechanism from one station to the next. A screw conveyor chip trough that carries chips along the length of the machine and deposits them in containers is cast in the machine base.

At the first station two tubes are gripped by clamps in the overhead bar and transferred to the second station, where one end of each tube is flared by a mandrel. In the third station both ends of the tubes are faced and chamfered, the flared end is turned to the required outside diameter, and the other end is rough-bored. A finish-boring operation is performed on both tube ends at the fourth station. The tubes are deposited in a rack type unloader at the fifth station. All machining heads are hydraulically operated. The machine is 24 feet long. Hydraulic power is supplied by a separate power pack having a 10-H.P. motor. Push-buttons control the setup and operating cycles.

Circle Item 127 on postcard, page 231

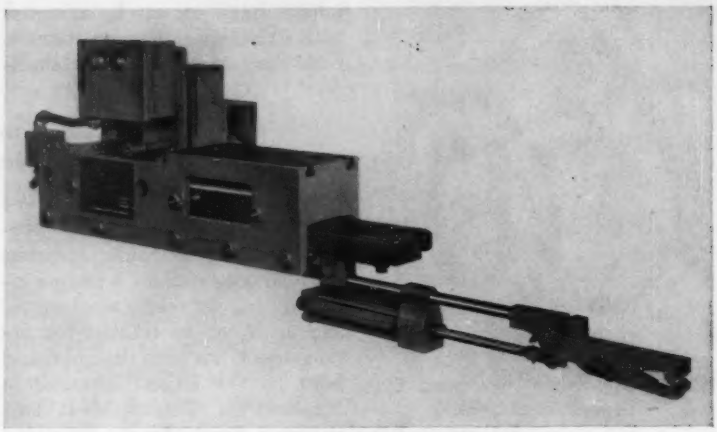


Expert automated, in-line, transfer, double-end machine that machines both ends of steel tubes at the rate of 414 tubes per hour

Sesco Automatic Press Unloader

Sesco, Inc., Detroit, Mich., has added to its line of machine tools and press-room equipment a line of automatic press unloaders. These machines have been developed to increase production by utilizing the full capacity of the presses; provide savings in the unloading operations; improve safety conditions by reducing unloading accidents; and reduce production costs.

The unloader assembly is contained in a compact, durable casting mounted on the press. It is synchronized with the press through a limit switch and is operated by two air cylinders; a main cylinder, or lift cylinder; and a cylinder for opening and closing the jaws. The operating cycle is very simple. When the press signals that it is clear for unloading, the jaw cylinder moves the open jaw forward. At the end of the forward stroke, the jaw grips the part. At this point, the main cylinder retracts, lifts the stamping out of the die, and swings it clear of the press. The jaw cylinder then retracts, unclamps the part on a table or conveyor, and trips a limit switch. The main cylinder then returns to its normal waiting position.



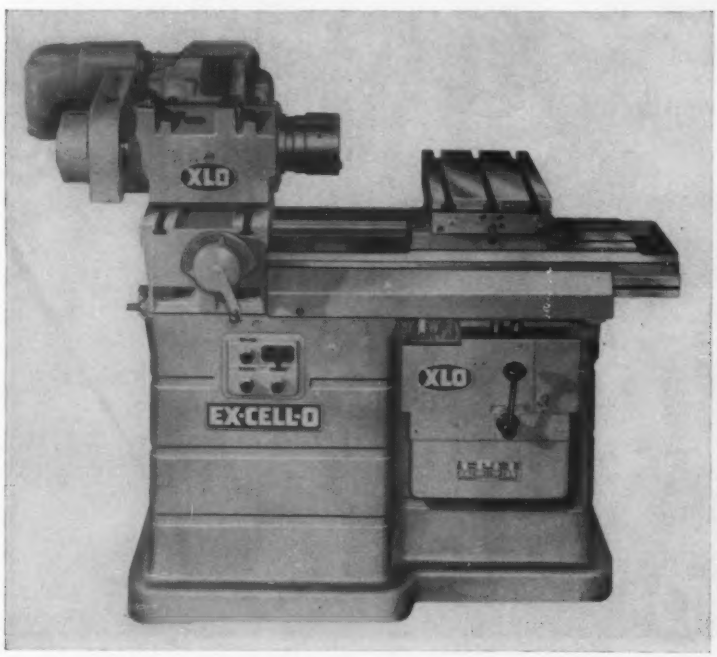
Automatic press unloader brought out by Sesco, Inc.

The unloaders are available in five standard sizes to meet most unloading conditions. Jaws are adjustable to suit width of parts, loading heights, and for the angle of travel into the die. Parts can be swung out any distance desired, depending upon the method of mounting and the length of the arm. The unloader unit shown in the illustration has a main cylinder stroke of 12 inches. Through the use of a double rack and pinion, the stroke can be doubled.

Circle Item 128 on postcard, page 231

Ex-Cell-O Precision Boring Machine

The high-production, Style 2112-B, precision boring machine built by the Ex-Cell-O Corporation, Detroit, Mich., can also handle a wide variety of toolroom work and short production runs. This is made possible by providing the machine with selective cycle equipment, a variable-speed drive, and an Ex-Cell-O universal fixture as shown in the illustration. The horizontal slide of the fixture can be operated manually or hydraulically. A vertical slide (not shown) can be mounted parallel or at right angles to the spindle. Change-over from one job to another is simple.



Ex-Cell-O boring machine equipped to handle toolroom work and short production runs

Boring, turning, grooving, chamfering, and facing of medium-size and smaller parts can be performed on this precision boring machine. With parts mounted on the cross-slide, the tools are carried by one or more rotating spindles, according to requirements. Or, small parts can be rotated on the spindles while the tools are statically supported on the cross-slide. The machine has a maximum table travel of 12 inches, table feeds of 1/2 inch to 130 inches per minute, and rapid traverse of 38 feet per minute.

Circle Item 129 on postcard, page 231

Vertical and Horizontal Speed Lathes

The Standard Electrical Tool Co., Cincinnati, Ohio, has brought out Types CP (vertical) and CSL (horizontal) speed chucking lathes. These units can be supplied with single-, multiple-, and variable-speed motors. They also can be had with electric brake motors to permit rapid starting and stopping.

Special spindle adapters can be supplied for this lathe to suit specific requirements. Various makes of hand or air chucks can also be furnished with the machines. In the event an air chuck is provided, a foot pedal is supplied as standard equipment, which simultaneously operates the air chuck and motor in proper sequence. Spindle speeds can be furnished to suit the customer's application.

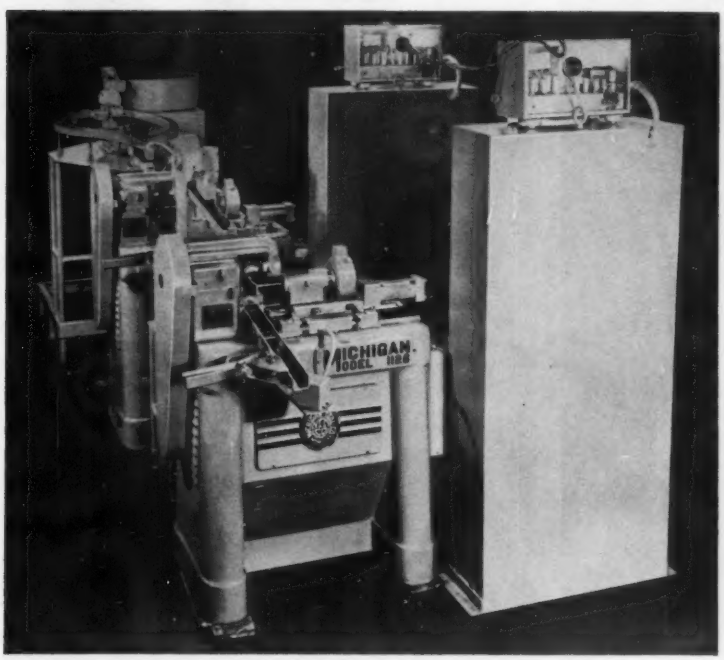
These machines were designed to perform secondary operations in finishing aircraft and automotive parts, including deburring, polishing, and blending.

Speed lathes made by Standard Electrical Tool Co.

Circle Item 130 on postcard, page 231

Automatic Speeder for Sound Testing Transmission Gears

Fully automatic sound testing of transmission gears in automotive and similar mass-production applications is now possible with Model 1126 gear speeders built by Michigan Tool Co., Detroit, Mich.



Gear speeder built by Michigan Tool Co. to automatically audio test two pinions in a cluster employing electronic equipment

The entire operation, including feeding of parts from a storage hopper, clamping and speeding of the gear, and either selective rejection for excess noise in any frequency band or passing through of the gear being tested, is done automatically.

Electronic audio inspection of gears eliminates dependence on the operator's sense of hearing and is an important factor in keeping noisy gears out of modern transmissions. It enables mass-produced spur or helical gears, either single or in a cluster, to be automatically audio tested to exact specifications. The electronic panels can be set up to reject gears for undesirable noise levels of high, low, or intermediate frequency at speeds within the working range of the gear. In addition, the time required to speed test marginal gears is materially reduced, since the control unit does not stop to consider whether the noise level merits rejection as does the operator who depends on the human ear. If the noise level exceeds the prescribed amount, rejection is positive and quick.

Model 1126 speeders can be set up in line to check automotive pinions as shown in the illustration. Since the face widths of both pinions are dissimilar, an orientator is used to assure that

work-pieces after leaving the storage hopper come to the test stations in the right order. The first speeder sound tests the first gear in the cluster, and the second speeder tests the second gear. The part is rejected at either sound tester if the audio range is undesirable.

Circle Item 131 on postcard, page 231

Circular Saw Blade Sharpener

A circular saw blade sharpener, designated the G-45, has been brought out by the Motch & Merryweather Machinery Co., Cleveland, Ohio. This machine sharpens blades from 8 through 45 inches in diameter. It will grind alternately high and low teeth with one setting, employing the company's "Triple-Chip" grinding process.

The high tooth is chamfered on either side, and the following tooth is square. The narrow tooth roughs out the center, and the wide tooth finishes the cut. As a result, three curling chips are formed by two teeth. The grinding contour is automatically produced by cam action, with index-plates controlling the tooth spacing. Varying diameters, thicknesses, rake angles, and pitches can be ground with this automatic saw sharpener.

Circle Item 132 on postcard, page 231

Air-Hydraulic Press

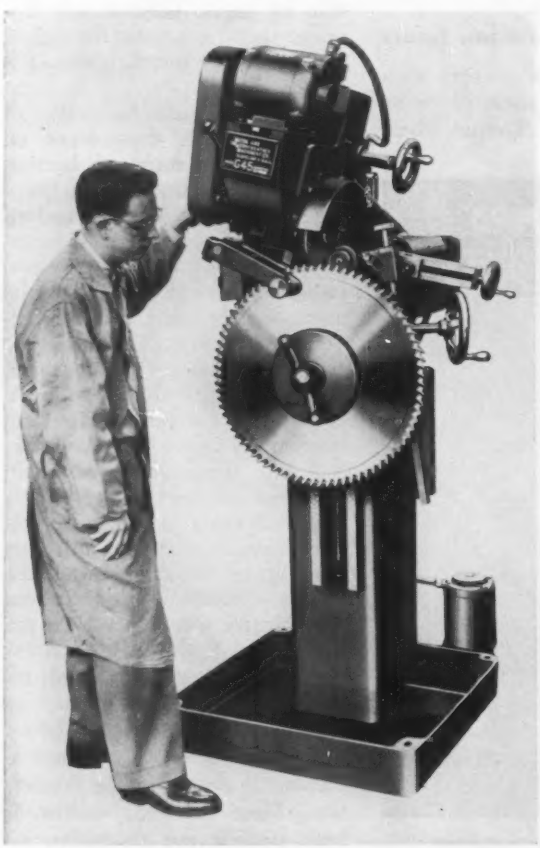
Air-Hydraulics, Inc., Jackson, Mich., is producing a large, low-cost air-hydraulic press with a normal rated capacity of 15 tons, which can be increased to 21 tons by employing an air-line pressure of 100 pounds per square inch. This C-500 model press is said to develop exceptional force in proportion to its size (15 inches wide, 26 3/4 inches deep, and 40 inches high). It is mounted on a stand 34 inches high.

The press is designed to give effortless and trouble-free performance with constant, equalized pressure. It will handle a wide range of materials from metal to leather and will perform operations such as forming, flanging, riveting, broaching, staking, and crimping. The standard model has an 8 1/4-inch throat and operates with a 6-inch stroke at ten cycles per minute. Other throat and stroke sizes are available. Three types of controls are offered—dual hand, foot pedal, and fully automatic. Many safety features protect inexperienced operators.

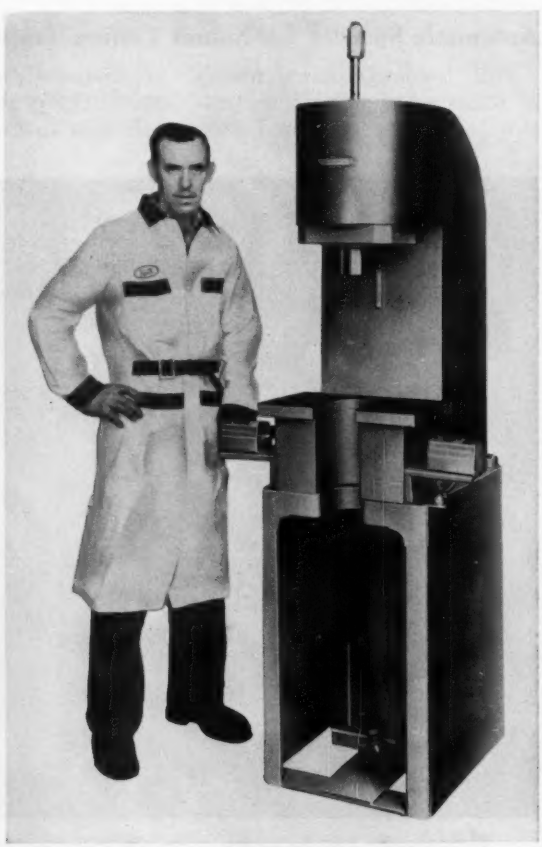
Circle Item 133 on postcard, page 231

Socket-Head Screws and Bolts with Nylok Self-Locking Insert

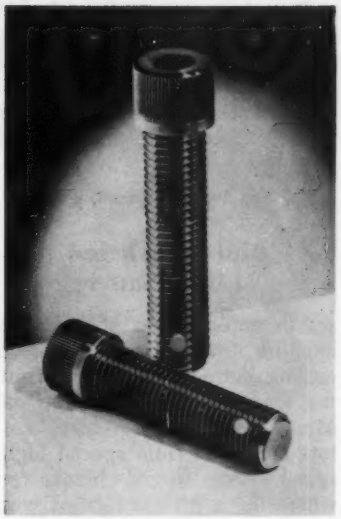
The Standard Pressed Steel Co., Jenkintown, Pa., has announced that the Nylok self-locking insert



Motch & Merryweather saw-blade sharpening machine



Air-hydraulic press with rated capacity of 15 tons



Socket-head screws with Nylok self-locking inserts announced by the Standard Pressed Steel Co.

is now available as an optional feature of its precision socket-head screws and aircraft bolts. Under license from the Nylok Corporation, New York City, Standard Pressed Steel and its affiliates—the Cleveland Cap Screw Co., Cleveland, Ohio, and Cooper Precision Products, Los Angeles, Calif.—will incorporate the Nylok self-locking device in male threaded fasteners of all types, including standard and special products.

With this device, the self-locking action of a nylon pellet, inserted in a hole drilled part way through the threaded portion of the bolt, resists the tendency of the bolt to loosen when it is used in machine tools, vehicles, appliances, and other equipment subjected to vibration and temperatures ranging from minus 70 to plus 300 degrees F., even through repeated use.

Circle Item 134 on postcard, page 231

Mag-Tool Drill Press

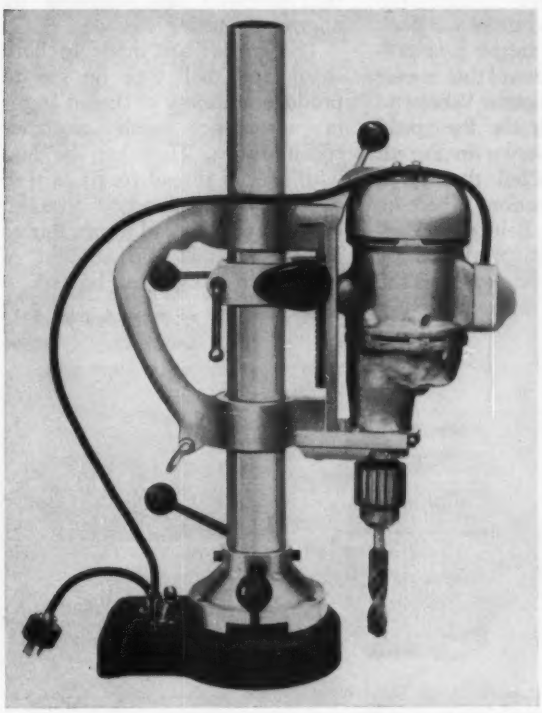
The Magnetic Tool Corporation, Santa Clara, Calif., has announced immediate availability of the "Mag-Tool" drill press with electro-magnetic base which magnetically attaches to ferrous surfaces for on-the-spot drilling, tapping, reaming, and other drill press operations. This portable drill press weighs only 45 pounds and operates in any position—drilling holes up to 2 inches in diameter. Adjustments enable the drill bit to be precisely positioned after the magnetic base has been locked in place.

Circle Item 135 on postcard, page 231

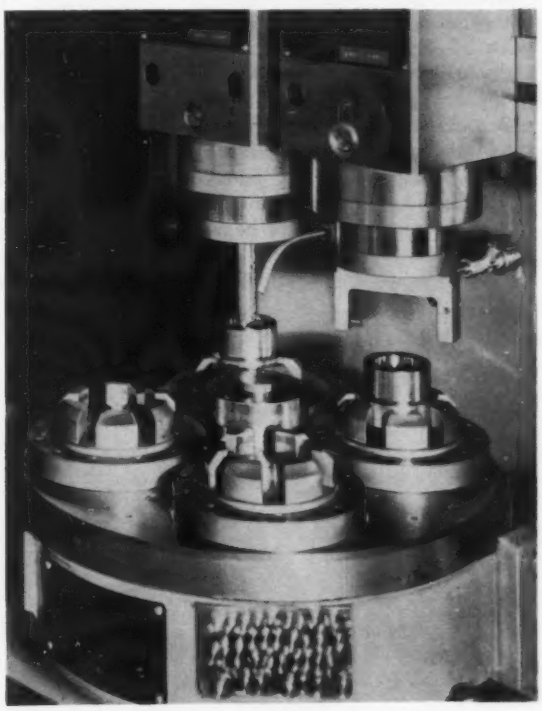
Automatic Precision Indexing Table

A Model AIT automatic indexing table, accurate within 0.0005 inch of true position, has been brought out by the Wadell Equipment Co., Garwood, N. J., for use on its vertical precision boring machines for boring, drilling, turning, or reaming operations. The table is completely electrical and can be synchronized with the machine cycle or manually indexed. Although designed primarily for use on the manufacturer's precision boring machines, it is readily adaptable to other machine tools.

The index drive features a mechanism which requires only three moving parts. Accuracy is governed by a master index-plate, precision machined by utilizing a jig borer which assures total toler-



Portable drill press with electro-magnetic base brought out by the Magnetic Tool Corporation



Wadell indexing table mounted on vertical boring machine equipped with four diaphragm chucks

ance of index positions within 0.0003 inch.

The lock-pin is of heavy rectangular cross-section and moves on preloaded rollers, eliminating all play. The table rotates on preloaded, precision, heavy-duty tapered roller bearings which provide rigidity and allow for thrust loads in all directions. The hollow spindle permits the use of air-operated or hydraulically actuated chucks or other holding means.

The standard master plates have twelve index positions, and masks are used to obtain two-, three-, four-, and six-division spacings. Provision can also be made for irregular spacings. Diameters of 12, 18, and 24 inches are standard.

Circle Item 136 on postcard, page 231

Danly Lubrication Gun for Die Sets

Danly Machine Specialties, Inc., Chicago, Ill., has brought out a lubrication gun designed to facilitate the lubrication of die sets. Guide post bushings can be easily reached from the front or side of the press because of the long narrow body of the gun.

The nozzle regularly furnished with the gun is designed for use with oil or grease and is especially adapted for the application of Danly die set lubricant.

A close-fitting high-pressure steel piston which is carefully ground and polished is a feature of the lubrication gun. The cylinder of the gun is made of heavy-gage steel to withstand hard usage.

Circle Item 137 on postcard, page 231

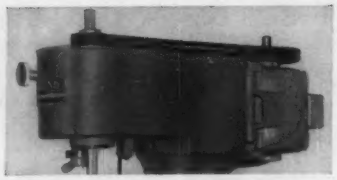


Fig. 1. Edlund drilling machine with single-speed drive

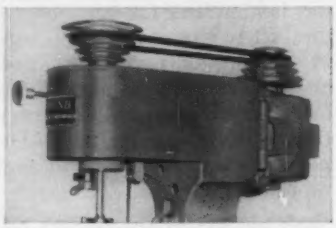


Fig. 2. Five-speed drive applied to Edlund drilling machine

Drives Developed for Edlund Drilling Machine

Single-speed and five-speed drives have been developed by Edlund Machinery Co., Cortland, N. Y., for its Model 2F drilling machine. The drives are designed for long production runs on work requiring either one or several preselected speeds. With the single-speed drive (single-step sheave) Fig. 1, the drive for positive drilling and tapping is provided directly from the motor through twin A-section V-belts to the spindle. With the five-speed drive, which is shown in Fig. 2, power is transmitted through a positive grip B-section V-belt on a five-step sheave. Belt tension adjustments and belt speed changes are made from the front of the machine.

Both drives can be furnished in any selection of speeds and may be changed to other preselected speeds or be converted to the infinitely variable speed drive of the Model 2F drilling and tapping machine.

Circle Item 138 on postcard, page 231

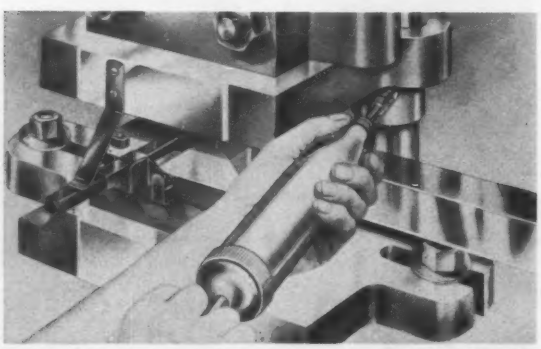
Multiple-Thread Milling Cutters

A complete line of accurate, long-life, low-cost, multiple-thread milling cutters is available from the Star Cutter Co., Farmington, Mich. These "Star-Process" cutters are made from special high-speed steel forged blanks on which the teeth are formed with master form tools in a three-step production operation prior to a precision heat-treating operation.

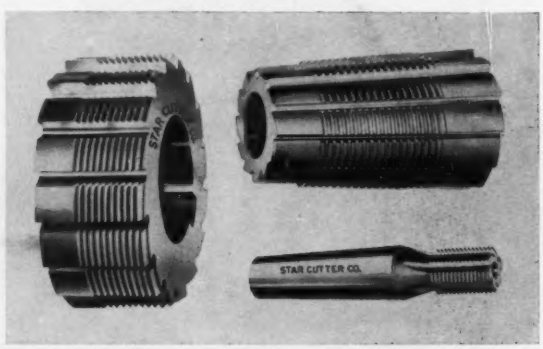
The extreme precision maintained in the heat-treating operation makes it necessary to grind only the faces of the teeth and mounting surfaces after heat-treatment. This process is said to produce multiple-thread milling cutters with the superior thread spacing and form accuracy provided by master form tools and the increased life provided by unground cutting surfaces.

The cutters are made in both shank and shell type designs to produce a variety of thread forms in accordance with customer specifications. They can be had with special thread forms as well as any of the standard straight, taper, or pipe thread forms. Radial or hook grinds and straight or spiral gash designs can be had.

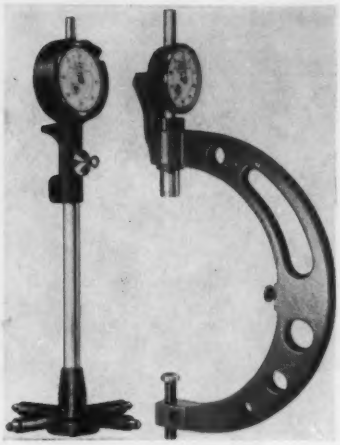
Circle Item 139 on postcard, page 231



Gun for applying lubricant to die sets made by Danly Machine Specialties, Inc.



Assortment of "Star-Process" multiple-thread milling cutters made by Star Cutter Co.



(Left) Federal dial indicator gage for checking bores of railway wheels. (Right) Dial snap gage for measuring wheel seat diameter of railway axle

Gages for Checking Axles and Wheel Bores of Railway Equipment

To facilitate the work of railroad maintenance shops in turning down wheel seats and boring the wheels to obtain the accurate fits demanded by fast train speeds, the Federal Products Corporation, Providence, R. I., has brought out two series of dial indicator gages for checking the critical dimensions.

The 264 P-400 series dial snap gage, shown at the right in the illustration, measures the wheel seat diameter of the axle. Each gage can be adjusted to measure two sizes of axles. Also, the gage requires only one master setting to measure an axle from "new" to "scrap" condition. This is the amount that an axle can be turned down before it is too small to be usable—generally 0.375 inch There are five sizes of snap gages in the series which cover axle sizes from 5 1/8 to 8 3/4 inches. The gaging contacts are made of tungsten carbide to give maximum wear.

The diameter of the bore where the wheel bears on the axle is checked by vertical type hole gages (Models B4F P-3 and B4F P-4) of the design shown at the left in the illustration. Each of these gages has four contact points—two gaging and two centralizing. The Model B4F P-3 has four sets of contacts to cover bore sizes from 5 1/8 through 6 5/8 inches, while Model B4F P-4 has seven sets to cover sizes from 6 1/2 through 8 3/4 inches.

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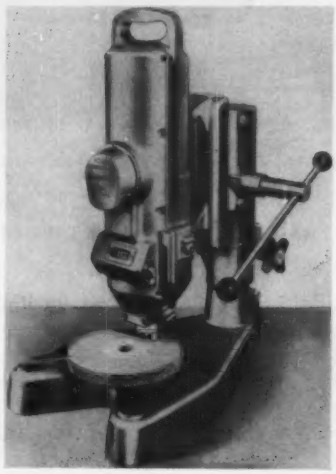


Hardness testing machine introduced by the George Scherr Co.

Grinding Wheel Hardness Testing Machine

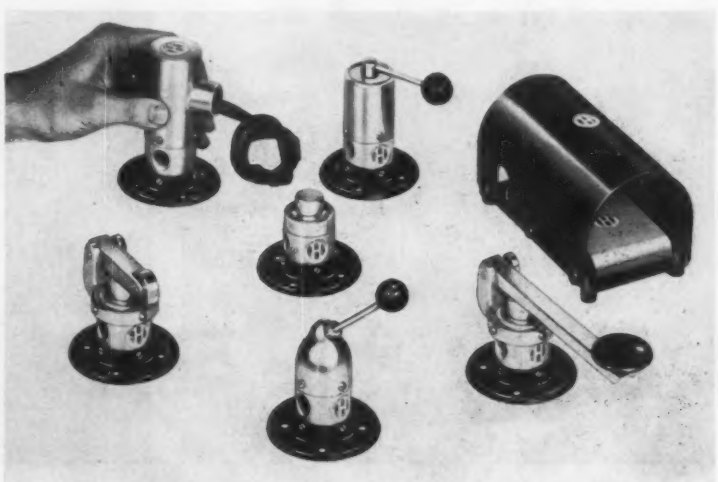
The George Scherr Co., New York City, is introducing a machine for testing the hardness of grinding wheels. This machine is designed to apply a dynamic test by means of a reciprocating and rotating chisel held under a certain pressure. The pressure exerted, the number of reciprocating strokes, and the revolving speed of the chisel at the moment of impact are designed to simulate—as nearly as possible—the actual stress to which the grain imbedded in the wheel is subjected in actual use.

The test records the number of strokes of the revolving chisel required to penetrate the wheel to a depth of 3 millimeters. The test includes: first, stroke frequency recorded on a counter; second, speed of chisel rotation at the moment of impact; and third, hitting force of the chisel, which is constant. This new process hardness tester is said to be capable of solving many grinding problems.

Circle Item 141 on postcard, page 231

Humphrey "Quick-Dump" Valves

A line of "Quick-Dump" flow-control valves, said to incorporate a basic improvement in design, has been placed in production by Humphrey Products, a subsidiary of the General Gas Light Co., Kalamazoo, Mich. These valves are intended for use in original equipment, as well as numerous applications in industry that require either manual or automatic valving of air, water, oil, or Freon. They utilize a single basic valve body which may be used either normally open or normally closed,



"Quick-Dump" valves announced by Humphrey Products

depending upon port connections. To this standardized valve body may be added a variety of simple devices for triggering the valve action.

Seven models are available—solenoid-, cam-, palm-, button-, fingertip-, and foot-operated designs and two types for hand-lever operation. The opening, closing, and holding actions are effected by the pressure of the air or liquid, the valving action working with the pressure instead of against it. Valve action is triggered by a light touch and shut-off positive.

The valve is adapted for applications up to 125 pounds per square inch and under temperature variations from minus 40 to 225 degrees F.

Circle Item 142 on postcard, page 231

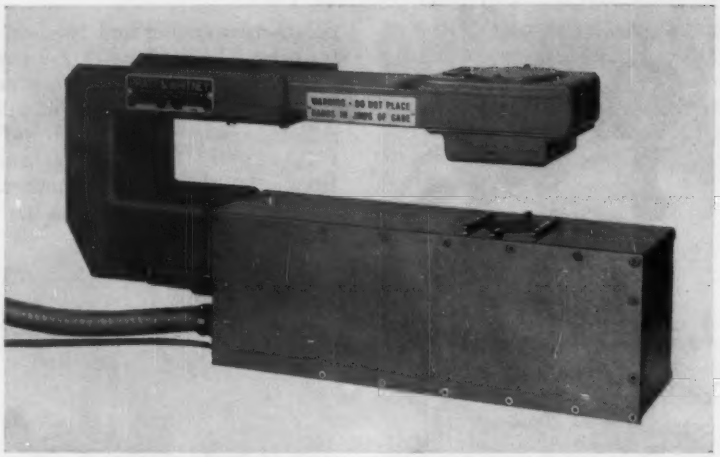
Fine-Feed Boring Attachment for Radial Drills

The American Tool Works Co., Cincinnati, Ohio, is now offering a fine-feed boring attachment for use on the de luxe models of its 9-inch and 11-inch column "Hole Wizard" radial drills.

This attachment is furnished in addition to the standard feeding mechanism. The fine-feed range for precision boring provides six feeds from 0.001 to 0.00625 inch per revolution of the spindle.

The change from the standard feed range to the fine feed range, or vice versa, is made instantly through a conveniently located lever at the lower right-hand side of the head. Simply flipping the lever reduces the standard feed range 75 per cent.

Circle Item 143 on postcard, page 231



Pratt & Whitney X-ray gage for measuring thickness of aluminum foil

P&W X-Ray Gage for Measuring Aluminum Foil

A continuous process of controlling the thickness of aluminum foil has been achieved by the use of an X-ray gage brought out by the Pratt & Whitney Co., Inc., West Hartford, Conn. In developing this equipment for the continuous measurement of aluminum foil, advantage was taken of the X-ray's ability to detect the presence of metal while ignoring or-

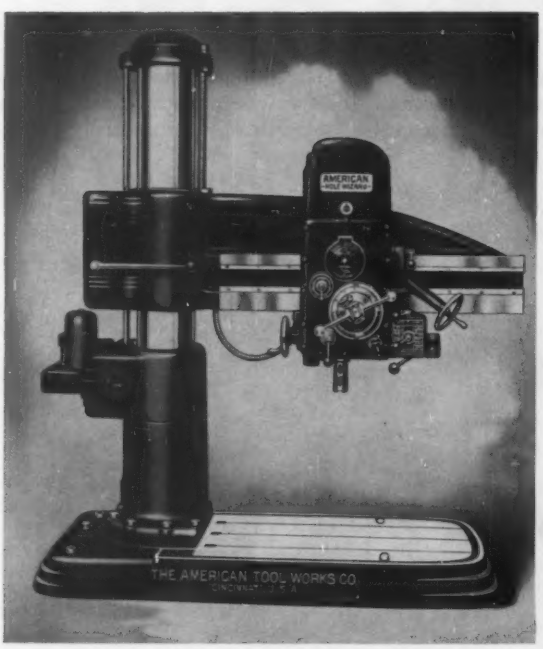


Fig. 1. "Hole Wizard" radial drill built by American Tool Works Co., with fine-feed boring attachment

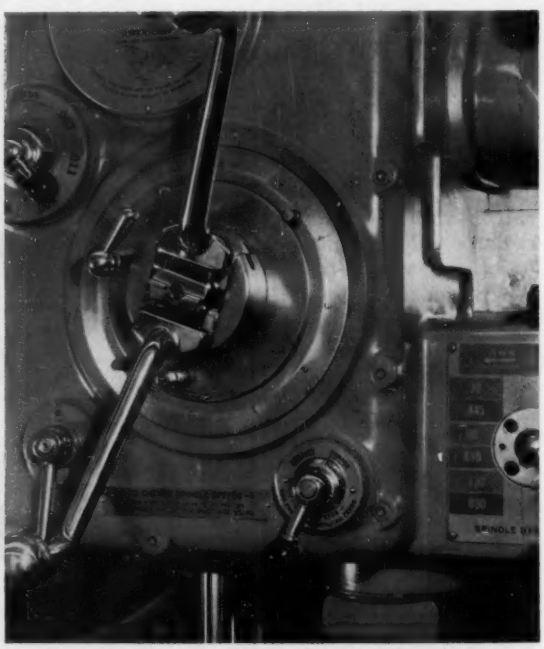


Fig. 2. Close-up view of fine-feed boring attachment applied to de luxe model "Hole Wizard" radial drill

MOST USEFUL HAND SCREW MACHINES ON THE MARKET

... the Brown & Sharpe Nos. 00, 0, and 2

You can handle the widest range of short run work and second operations, with highest productivity and economy, on Brown & Sharpe Hand Screw Machines. They provide the same spindle speed versatility as B&S Automatics: 196 2-speed combinations, providing a wide range of high to low ratios. In addition, they use the same tools, collets, and fingers as equivalent-size B&S Automatics — set-ups are exactly the same! Operation is easy too. For example: A convenient lever controls both high and low spindle speeds, and braking. "Natural position" turret control reduces operator fatigue. A handy trip-lever controls chucking and bar feed. For highest efficiency and economy, put your short runs and make-up jobs on B&S Hand Screw Machines. *Write for details.*

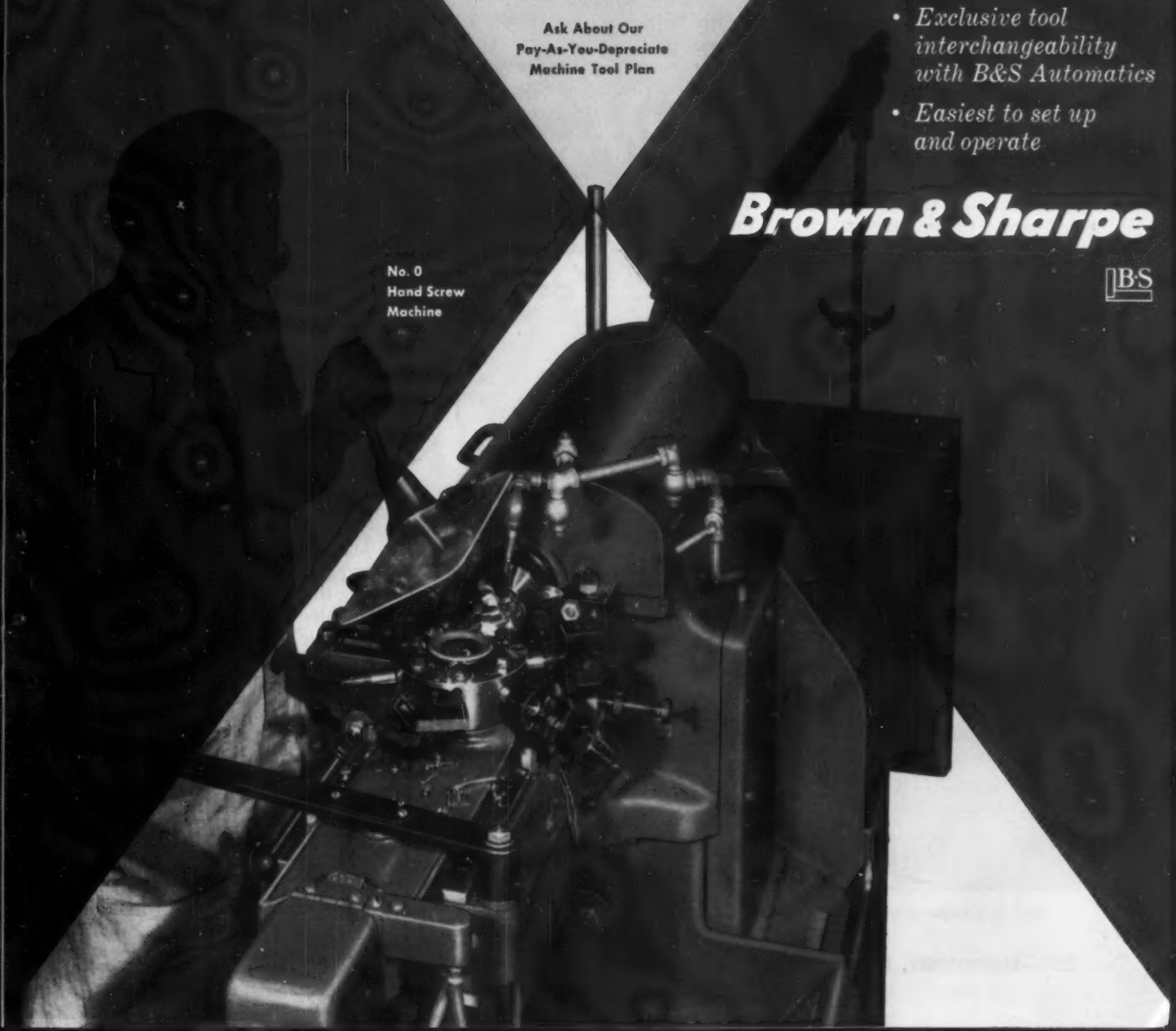
Brown & Sharpe Mfg. Co.,
Providence, R. I.

Ask About Our Pay-As-You-Depreciate Machine Tool Plan

- *Greatest number of spindle speed combinations*
- *Exclusive tool interchangeability with B&S Automatics*
- *Easiest to set up and operate*

Brown & Sharpe

B·S



No. 0
Hand Screw
Machine

ganic materials which are essential in the process of rolling aluminum foil.

A standard Pratt & Whitney X-ray gage for aluminum foil is calibrated for a thickness-measuring range of from 0 to 0.015 inch, permitting direct setting as well as direct readings to 0.00001 inch—or 10 millionths of an inch. Such precision had previously been possible only by the slow process of accurately weighing a sample of known area. The same basic X-ray gage can be used for steel and all other metals made in strip form.

Circle Item 144 on postcard, page 231

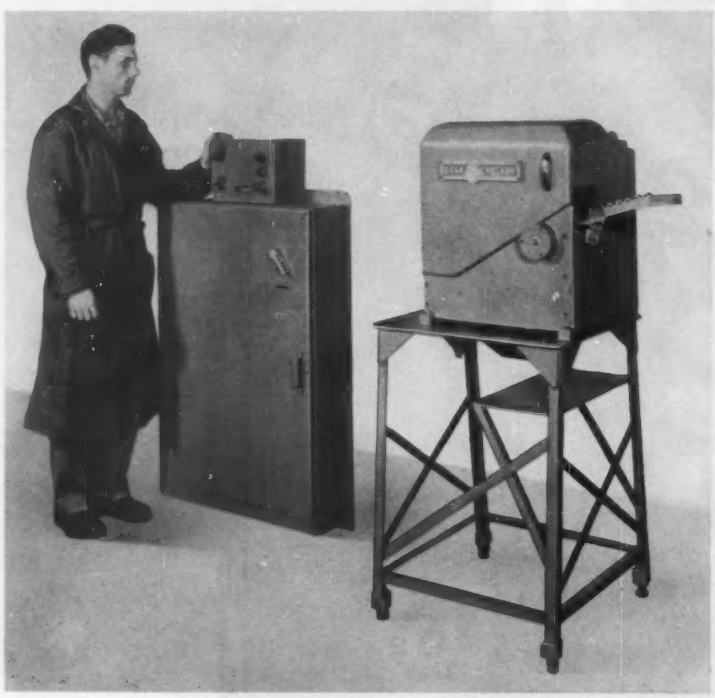
Red Ring Automatic Gear Gaging, Sorting, and Machine Control Unit

A Red Ring Model GRD automatic gear gaging, sorting, and machine tool control unit having standardized components—adaptable to the checking of individual spur or helical gears up to 3 inches in diameter and 3 inches in width—is now available from the National Broach & Machine Co., Detroit, Mich. This machine can be had in types that will check and sort production gears for both size and helix angle accuracy or either size or helix angle, as required. It will shut down gear production machine tools automatically after a specified amount of rejects of a specific type are gaged. Indicator lights designate the type of reject that caused the shut-down.

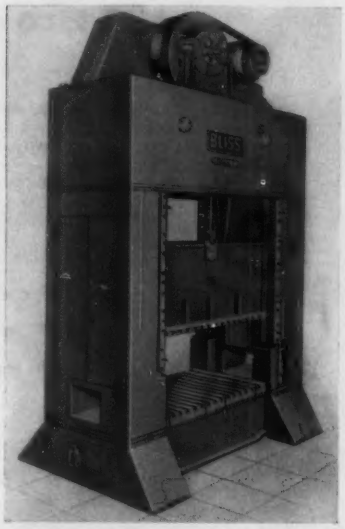
The complete machine consists of a motorized gaging and sorting unit through which the gears are fed automatically, one at a time, from an inclined feed chute; a stand that supports the gaging unit and reject pans; a separate electrical panel; and an individual push-button and indicator light control box. The panel and control box can be mounted either near the machine or at some remote location.

Gears that meet the requirements pass through the gage and are deposited on the factory conveyor line. Solenoid-controlled trap doors actuated by the electric indicators enable the gaging unit to sort rejects and deposit them in pans under the unit.

Circle Item 145 on postcard, page 231



Red Ring automatic gear gaging, sorting, and machine tool control unit



"Basic" press announced by the E. W. Bliss Co.

Press of "Unitized" Design

Eccentric-geared presses of "unitized" design, developed to simplify maintenance and allow buyers to build presses to suit individual needs, have been announced by the E. W. Bliss Co., Canton, Ohio. The design of this line of single-action, two-point presses is based on a "unitized" principle of construction. This involves a quill-mounted flywheel and overhung clutch built into a "unitized" gear case on which the main motor drive is mounted. Except for the main gears, nothing is built into the crown.

All machines in this line are available as "basic" presses with no inbuilding or extras unless specified. This makes them especially useful in job shops, as well as in highly automated mass-production plants.

Among the special features that can be added—in whole or part—to the "basic" press design are: provision for automation controls and feeds; inbuilding; various types of automatic lubrication; air and electrical outlets for maintenance tools; die lights; air control manifolds; special controls; and many others. The presses are available in a full line of tonnages in both double- and single-geared models.

Circle Item 146 on postcard, page 231

(*Continued on page* 228)

One set-up saves 30%

Photos courtesy of the Kelman Electric & Mfg. Company, Los Angeles, California.

Boring, facing, and high speed drilling with one set-up cut the floor to floor time about one-third on this job.

The Kelman Electric & Mfg. Company say their Cincinnati Super Service Radial Drill "handles easily, is very accurate and versatile."

They are facing 6" diameters; drilling for ½" bottom tap, and tapping with a ½" bottom tap on this job.

The part being processed is a Bronze Top Casting.

Cincinnati Super Service Radial Drills are profit makers in this shop, and they could be in yours.

Write for Bulletin R-21C

CINCINNATI BICKFORD

SUPER C·B SERVICE

RADIAL AND UPRIGHT DRILLING MACHINES

CINCINNATI BICKFORD DIVISION
GIDDINGS & LEWIS MACHINE TOOL COMPANY
OAKLEY, CINCINNATI 9, OHIO, U.S.A.

For more information fill in page number on Inquiry Card, on page 231

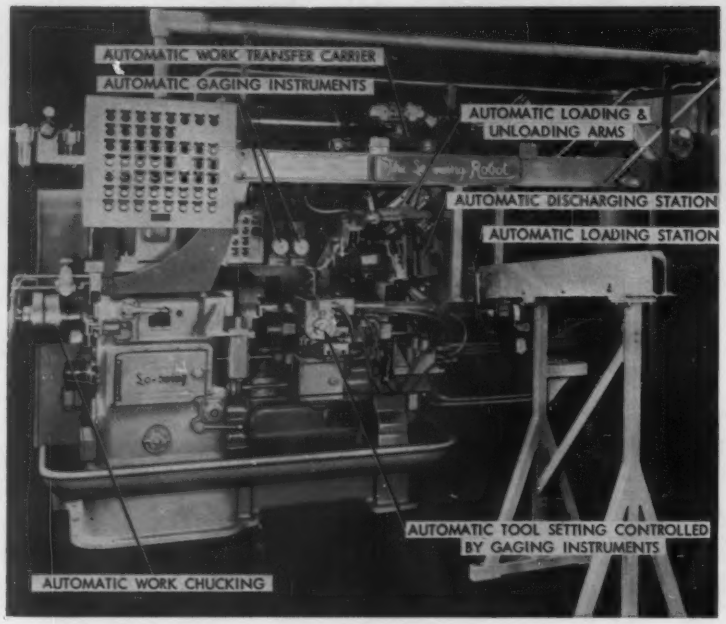

AUTOMATIC WORK TRANSFER CARRIER
AUTOMATIC GAGING INSTRUMENTS
AUTOMATIC LOADING & UNLOADING ARMS
AUTOMATIC DISCHARGING STATION
AUTOMATIC LOADING STATION
AUTOMATIC TOOL SETTING CONTROLLED BY GAGING INSTRUMENTS
AUTOMATIC WORK CHUCKING

Fig. 1. Lo-swing lathe equipped for automatic handling and sizing of electric motor stators

Seneca Falls Lo-swing Lathes with Automatic Work-Handling and Sizing Equipment

The Seneca Falls Machine Co., Seneca Falls, N. Y., has equipped a Model LR automatic Lo-swing lathe for machining the outside surfaces of small electric motor stators to the required diameter. The illustration shows one of the machines supplied for this class of work which automatically performs the following functions: input conveying; loading of parts; machining operation; unloading of parts; gaging with feed-back for tool adjustment and tool indexing; and output conveying.

The stators are fed by gravity down the input conveyor into a pivoting cradle which elevates a rough stator into the loader-arm fingers of the work-transfer carrier. The carrier then moves to the loading station, located over the tooling area of the lathe. On completion of the machining operation on a previously loaded part, the spindle stops and the finished part is removed by the fingers of the unloader arm. The loader-arm fingers then lower a rough stator and position it on an expanding arbor where it is securely clamped by an air cylinder mounted on the end of the spindle. The loader arm then retracts and the headstock spindle clutch is energized, starting the machining operation.

The finish-turned stator, which is in the unloader-arm fingers, is then transferred to the output conveyor and is fed by gravity to the gaging station at the rear of the lathe. Gaging is done by the "Lectrolair" system and the stator is checked for size on both ends simultaneously. If the part registers on the mean tolerance, no signal is given. However, if the diameter tends to increase, but is still within the tolerance, a signal is stored in a memory device to count the pieces of such size. After a predetermined number of consecutive parts showing this trend to increased size have been produced, a signal is sent to the control panel, and the turning tool is automatically advanced 0.0005 inch, bringing the turned diameter just over the low limit.

This procedure will be repeated a predetermined number of times, after which the turret toolpost will be automatically indexed to present—in working position—another of the four tools in the four-tool turret. After the four tools have been used, the machine will stop, and a signal light will go on.

Circle Item 147 on postcard, page 231

(*Continued on page* 236)

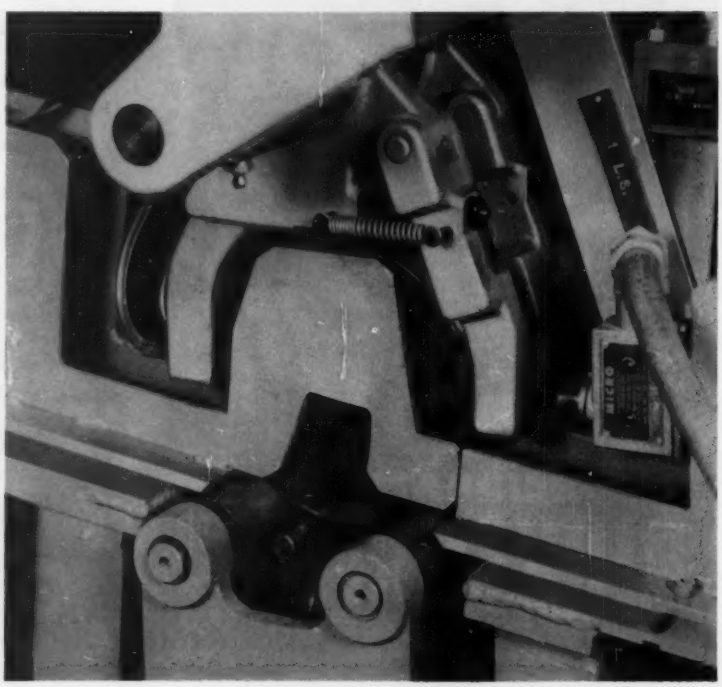


Fig. 2. Close-up view of sizing gage on lathe shown in Fig. 1, with stator held in position by gaging fingers

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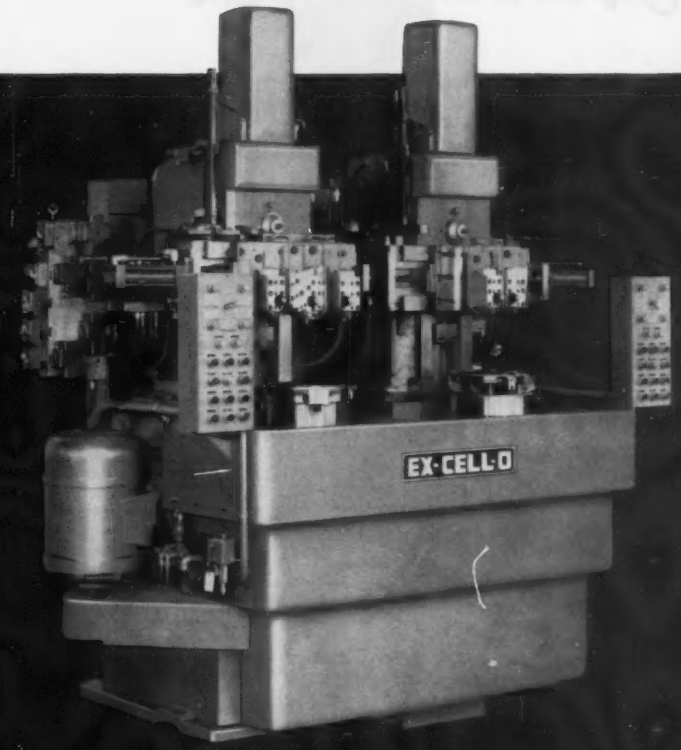


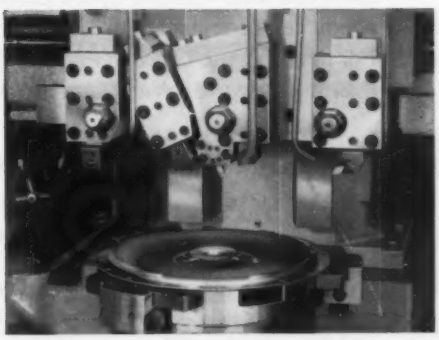
EX-CELL-O STYLE 432 VERTICAL PRECISION BORING MACHINE has two independent hydraulic systems. No cams to change.

The Ex-Cell-O Style 432 completes the operations on both sides of this transmission torque converter cover in one machine cycle.

Ex-Cell-O's new Style 432 Vertical Precision Boring Machine was designed to speed production *where flexibility is essential.* Vertical construction means convenience in loading and unloading parts, also ease in adjusting and changing tools. Precision turning, boring, facing, grooving, and chamfering are performed alone, or in any combination.

Tool one station for operations on one side of a part; tool the other station for different operations on the other side. Or—let both stations do identical operations simultaneously or in sequence. Or—each station works as an independent machine. Different cycles are obtained through switches, and adjustment of dogs and orifices.

For complete information, call your local Ex-Cell-O representative, or write Ex-Cell-O in Detroit for Bulletin.



Tooling and chucking equipment of the left station. Slides are wide enough to accommodate tools on both sides of the centerline of a part.

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Use it as a saw or a file on heavy-duty production line work. Fit it with a blade and it becomes a utility saw capable of cutting practically every material and every possible shape . . . steel blade stock from your all-purpose band saw can be used for special applications. Add a file chuck and use it with round or flat shank files. Conversion takes 60 seconds. Designed with Variable Speed Control, its cutting action can be regulated to suit your work conditions. For details, write *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, New York.*

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4. **In the Automotive field** – installing car heaters, radios and "extra" items.
5. **In the Electrical field** – armature undercutting, cutting coils out of electric motors, filing burrs from stator slots.
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On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

ALUMINUM HANDBOOK—Aluminum Company of America, 781 Alcoa Bldg., Pittsburgh 19, Pa. 176-page book entitled "Alcoa Aluminum Handbook," giving data on wrought alloys; sheet and plate; wire, rod, and bar; extrusions; tube and pipe; electrical conductors; structural shapes; forgings; and casting alloys. Also, data on aluminum alloys and mill products are presented in easy-to-read tabular form. There is little text. Complete information is given on the most advantageous choice of aluminum products to fulfill a particular need. The book contains information on alloy standards, as well as the properties, sizes, and tolerances of mill products usually produced from them. The code numbering system employed to designate alloys and their modifications is explained. Sections on mill products discuss sizes, properties, and tolerances. Tables make it extremely easy to find complete information on any alloy and all of its fabricated thicknesses and sizes. In all, 140 tables tell the Alcoa alloy story. Copies of the handbook are available by writing on company letterhead to the above address.

HYDRAULIC VALVES — Commercial Shearing & Stamping Co., 1775 Login Ave., Youngstown, Ohio. 92-page catalogue giving factual information on commercial oil-hydraulic valves for controlling fluid power when used to control the operation of cylinders and motors. Performance data, capacities, types, sizes, and mounting dimensions of these valves are given to enable proper design and application into hydraulic systems. Illustrations include photographs of typical installations, cut-away drawings, and flow schematic of the valves needed for a complete heavy-duty oil-hydraulic circuit. A copy of this catalogue can be obtained by writing on company letterhead to the above address.

ELECTRONICS DATA HANDBOOK—Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill., 64-page electronics data handbook consisting of a carefully selected collection of the most needed formulas used in radio and industrial electronics. Formulas include those needed for basic circuit analyses, transmission line calculations, determinations of vacuum tube characteristics, resonance calculations, motor calculations, etc. The book—available from the above company—is priced 35 cents, postpaid. Stock number is 37K398.

HIGH-TEMPERATURE ALLOY—Haynes Stellite Co., 30-20 Thomson Ave., Long Island City, N. Y.—A Division of Union Carbide and Carbon Corporation. Booklet describing the company's Hastelloy alloy R-235—a wrought, nickel-base, aluminum and titanium bearing precipitation-hardening alloy with outstanding properties through 1750 degrees F. Copies can be obtained by writing to the company.

FEEDS AND SPEEDS CHART—Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. Chart giving safe feeds and speeds for high-speed drills for use in cast iron, bronze or brass, and drop forgings, alloy steel and tool steel annealed. A copy of the chart is available by writing on company letterhead to the above address.

OVERHEAD MATERIALS HANDLING SYSTEMS—Cleveland Tramrail Division, Cleveland Crane & Engineering Co., Wickliffe, Ohio. Booklet 2008-M, covering the principal components of overhead materials handling systems. Track design and advantages of supporting it flexibly are described in detail. Included are formulas and figures for comparing various track sections. Among the subjects featured are various carriers for hand, electric, and automatic operation; tractors; track switches; standard cranes, transfer cranes and gantry cranes; safety electrification; and buckets and grabs. 1

SWAGING MACHINES—Fenn Mfg. Co., Newington, Conn. Catalogue illustrating the company's complete line of swaging equipment. It contains basic technical information about the rotary swaging process, its principles of operation, and advantages as a precision production method; and it explains many typical as well as unusual applications. One section of the catalogue displays the complete line of swaging machine accessories, including manual feeds and coolant systems. 2

VAPOR DEGREASERS—Circo Equipment Co., Clark (Rahway), N. J. 24-page catalogue describing use, operation, and maintenance of all types of vapor-degreasing equipment made by the company. The catalogue features perspective drawings of Circo degreasing equipment with cut-away schematic drawings. Over two hundred types of degreasers are described. These include straight vapor, vapor and liquid, and special systems which embody vapor phases. 3

AIR-CONTROL VALVES — Airmatic Valve, Inc., Cleveland, Ohio. 72-page catalogue illustrating the company's entire line of two- and three-way air-control valves for high- and low-pressure installations. The following new type valves are included: cam, flow control, foot, hand, interlocking, pilot, pressure regulator, quick exhaust, sequence, solenoid, time delay, and booster. Also presented are single- and double-acting cylinders for air or hydraulic use and strainers for pipeline protection. 4

CARBIDE GRINDING WHEELS—Robertson Mfg. Co., Trenton, N. J. Bulletin describing and illustrating abrasives for

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grinding carbide tools. Information is given on standard wheel types and sizes for various operations. Wheel sizes, plate specifications, and blueprint numbers of twenty-three plate-mounted, vitrified wheels for thirty grinding machines are given. This information is followed by "tips" on grinding carbide-tipped tools. **5**

SELF-LOCKING FASTENERS — Nylok Corporation, Elmira Heights, N. Y. Catalogue 11B, describing the company's complete line of one-piece, self-locking fasteners. The locking principle consists of a tough nylon plug embedded permanently in the threaded section. It can be applied to any male or female threaded part, making a positive, leakproof joint which cannot be jarred loose by shock or vibration. **6**

RECTANGULAR-SHAPED MOTORS — Leece-Neville Co., Cleveland, Ohio. Leaflet illustrating and describing the company's line of rectangular-shaped motors. The motors, which are available with a 12-volt capacity and outputs up to 115 ounce-inches, feature a special pole pattern which makes possible a flux path that is axial with the armature shaft, rather than concentric with the shaft as in conventional motors. **7**

BROACHING MACHINES — Colonial Brooch & Machine Co., Detroit, Mich. Bulletin MVT-56, describing the operating characteristics and capacities of the company's ElectroGear Model MVT dual-ram brooching machines. Included is a brief description of the drive design that permits these machines to operate with exceptional smoothness and gives improved surface finishes at up to 200 per cent faster cutting stroke. **8**

FORGED STEEL FITTINGS—W-S Fittings Division, H. K. Porter Co., Inc., Roselle, N. J. Catalogue No. A-3-56, giving complete dimensional, engineering, and application data on the company's forged screw-end and socket-welding fittings for high-pressure service. The catalogue features a reorganization of data into simplified charts permitting faster and easier location of information. **9**

CONTROLLED - ATMOSPHERE FURNACES—Furnace Division, Lindberg Engineering Co., Chicago, Ill. Bulletin 97-HS, describing the company's line of Hydryzing furnaces for hardening high-carbon and high-speed tool steels without scale, decarburization, or carburization. Cross-section diagrams, specifications, and performance data on both preheat and high-speed furnaces are listed. **10**

DIAL INDICATOR—Petz-Emery, Inc., Pleasant Valley, N. Y. Bulletin 656, describing the company's "Em-re" 0.00005-inch dial indicator and giving explanation of how it provides readings to the accuracy of 0.00004 inch. Described is also the company's "Master" dial indicator checker which provides users with a quick, reliable means of checking dial indicator accuracy at location. **11**

GRINDING MACHINES AND LATHE CENTERS—Ready Tool Co., Bridgeport, Conn. 16-page illustrated catalogue describing the company's RED-E line of cylindrical grinding machines, lathe centers, and grinder dogs. This catalogue has been revised to include the company's newest products together with data needed to simplify proper selection of these machine tools. **12**

TORQUE CONVERTERS—National Supply Co., Pittsburgh, Pa. Folder No. 468, describing the company's heavy-duty, single-stage, hydraulic torque converters for transmission of 100 to 1000 H.P. to industrial machinery. The folder gives features and specifications of seventeen sizes and capacities of torque converters for exact matching with engines in this power range. **13**

GROOVING MACHINES—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 76-C, describing the company's modernized Model 48-U universal power grooving machine which is equipped with a multi-purpose horn. Full details and specifications for this machine, as well as for hand-operated and giant power groovers, are included along with step-by-step illustrations. **14**

ELECTRIC MOTORS—U. S. Electrical Motors, Inc., Los Angeles, Calif. Bulletin 1878, describing the company's line of electric motors. Included are open type Uniclosed designs, totally enclosed and explosion-proof types, Varidrives, Syncrogears, right-angle worm gear models, and vertical and Verticlosed hollow shaft types. **15**

PRESS BRAKES—Cleveland Crane & Engineering Co., Wickliffe, Ohio. Catalogue entitled "Steelweld Press Brakes", giving construction details of the company's press brakes. Dimensions and specifications are given for the entire standard line of press brakes which range in bending capacity to 14 feet by 3/4 inch mild steel. **16**

FLUID-POWER STEEL TUBING—Joseph T. Ryerson & Son, Inc., Chicago, Ill. Bulletin 12-6, serving as a buyers' and designers' guide to specially processed steel tubing and cold-finished steel bars for hydraulic cylinders and fluid lines. Engineering data on Rockrite cylinder tubing and hydraulic fluid-line tubing are given. **17**

BALANCING MACHINE—Tinius Olsen Testing Machine Co., Willow Grove, Pa. 12-page bulletin describing the features and operating principles of the company's Vibrodyne balancer, a portable unit with a standard tunable pickup, which can be used for balancing parts or assemblies operating between 225 and 3600 R.P.M. **18**

TOOL BITS AND DRILL RODS—Firth Sterling, Inc., Pittsburgh, Pa. 8-page stocklist covering the company's tool bits, drill rods, and ground flat stock. This list includes thicknesses, widths, lengths, and decimal equivalents of all stocked sizes, as well as a brief description of grades stocked in the above named categories. **19**

FURNACES—Surface Combustion Corporation, Toledo, Ohio. Bulletin SC-174, describing three models of the company's Allcase furnaces that have an operating range from 1400 to 1750 degrees F. and can be used equally well for gas carburizing, clean hardening, dry cyaniding, carbon restoration, oil quenching, or marquenching. **20**

DETECTOR—Beta Corporation, Richmond, Va. Bulletin 500-5, describing the Model 5 Vibraswitch which is used to protect all types of rotated equipment against damage in the event of failing bearings or other mechanical malfunction. Control

Product Information Service

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circuit and type selection details are given. 21

VIBRATION CONTROLS—T. R. Finn Co., Inc., Hawthorne, N. J. Bulletin SVC-55, describing the basic theory of vibration isolation and shock absorption. It describes various types of machinery vibration; gives basic data, formulas, and graphs; and reviews practical methods of shock-vibration control. 22

PORTABLE ROTARY COMPRESSOR—Ingersoll-Rand, New York City. Form 2307, describing and illustrating the company's 85-cubic-foot-per-minute portable rotary compressor. With this addition, the company's Gyro-Flo line of portable compressors has been increased to six sizes—85 through 900 cubic feet per minute. 23

DIRECTIONAL CONTROL VALVE—Oilgear Co., Milwaukee, Wis. Bulletin 80300, describing the company's three- and four-way directional control valves for fluid power systems up to 3000 pounds per square inch. Included are details of the valve body construction and the functions of plungers. 24

TORQUE CONVERTER—Twin Disc Clutch Co., Hydraulic Division, Rockford, Ill. Bulletin 508, describing the company's 1500 series, single-stage torque converter. Illustrations and tables on the converter fluid circuit, horsepower and revolutions-per-minute capacity, and specifications are included. 25

DIVIDING COLLET HEAD—Kuma Tool Co., Division of Production Tool Corporation, Chicago, Ill. 4-page folder describing the company's redesigned universal dividing collet head. The collet head features interchangeable index-plates available in a range of 2 to 36 spaces. ...26

FORGED AND ROLLED RINGS—Alco Products, Inc., Schenectady, N. Y. 16-page bulletin describing the company's seamless forged and rolled rings. A handy 4-page chart showing in 8-inch divisions weights for rings from 1 inch to 145 inches over-all diameter is included. ..27

FLEXIBLE COUPLINGS—Lord Mfg. Co., Erie, Pa. Bulletin describing the features and applications of the company's flexible couplings which are custom-designed to meet any requirements. They are available in a wide range of sizes with torque capacities from 1/80 to 3500 H.P. ..28

ULTRASONIC TESTING INSTRUMENT—Magnaflux Corporation, Chicago, Ill. Folder describing the company's Sonizon Type SO-100 ultrasonic testing instrument designed for production use with the accuracy, stability, and ruggedness required by the airframe, foundry, and other industries. 29

FLUID POWER UNITS—Oilgear Co., Milwaukee, Wis. Bulletin 44200-A, describing the company's "Any-Feed Paks" designed to simplify fluid power application, and to provide precision fine feeds and high traverse speeds. These power "paks" are built in four sizes. 30

WELDING HEAD MANIPULATOR—Worthington Corporation, Harrison, N. J. Bulletin R-1700-B18, describing the company's automatic welding head manipulator mast type (10 x 12). Specifications, general description, special features, and other important data are included. ..31

GRINDING MACHINE—Ex-Cell-O Corporation, Detroit, Mich. Bulletin 46661, giving a complete description of the company's Style 49-A grinder, as applied to the sharpening of mining machine tool bits and rock drills. Particular reference is made to grinding carbide-tipped tools. 32

VERTICAL HOLLOW SHAFT MOTORS—General Electric Co., Schenectady, N. Y. Bulletin GEA-6521, describing the company's Tri-Clad 55 vertical hollow shaft motors. Information is given on design features and performance of these 7 1/2- through 30-H.P. pump motors. 33

PROTECTIVE COATINGS—U. S. Stoneware, Akron, Ohio. Bulletin 760, presenting useful data on painting in the form of charts, tables, diagrams, and illustrations. All factors relating to use of company's protective coatings are covered in detail. 34

LATHES—R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. 10-page booklet giving information on the company's 16-inch, heavy-duty engine lathe and plain bed cap lathe. Complete details are given on the new headstock which gives speeds up to 2000 R.P.M. 35

UNITIZED DUST COLLECTION—Torit Manufacturing Co., St. Paul, Minn. Booklet 56, describing the principles of unitized dust collection, dust damage, and general product information. A photomicrograph of various types of industrial dust is included. 36

HEAVY-DUTY MILL BEARINGS—Link-Belt Co., Chicago, Ill. Catalogue 2665, describing the company's heavy-duty mill bearings, designed for tough operating conditions where severe, radical thrust loads can be expected. Dimension and rating data are given. 37

ELECTROLYTIC GRINDING EQUIPMENT—Anocut Engineering Co., Chicago, Ill. Bulletin 300, entitled "Suggestions for Modification of Standard Grinding Equipment," outlining the procedures in adapting any standard grinder for use with the Anocut process. 38

POWER TRANSMITTING MACHINERY—Link-Belt Co., Chicago, Ill. Booklet 2653, describing and illustrating the en-

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tire line of the company's standard products—materials handling and power transmitting machinery. 39

MINIATURE CLUTCHES—Precision Specialties, Kansas City, Mo. 4-page catalogue describing the company's line of stock clutches in both miniature and subminiature sizes. Engineering and pricing information is given. 40

POWER PRESSES—Sales Service Machine Tool Co., St. Paul, Minn. Bulletin 955, describing the company's Press-Rite "Juniorline" power presses. Complete specifications are given, together with prices on both bench and floor model presses. . . 41

SET-SCREWS—Set Screw & Mfg. Co., Bartlett, Ill. 28-page Catalogue 21, listing and describing every type of set-screw and many special types designed to meet unusual conditions of vibration, close precision setting, and resistance to tampering, chemicals, or heat. 42

COUPLING SELECTION CHART—Morse Chain Co., Ithaca, N. Y. Chart, 22 by 17 inches, giving information on selection of flexible couplings. Condensed specifications of the company's three distinct types of couplings—roller chain, Morflex, and silent chain—are given. 43

COUPLINGS—Ajax Flexible Coupling Co., Inc., Westfield, N. Y. Catalogue 62, covering the company's Series D-100 standard floating shaft and mill motor type Dihedral couplings. Complete working data are given on sizes, capacities, and dimensions. 44

HYDRAULIC FEED UNITS—Hartford Special Machinery Co., Hartford, Conn. Descriptive bulletin, specification sheet, and price list covering the company's line of standard, horizontal, and vertical way type hydraulic feed units. 45

H.P.-MOTOR SELECTOR CHART—Howard Industries, Inc., Racine, Wis. Binder size fractional-horsepower motor selector chart illustrating speed torque curves for basic motor types and giving other valuable motor data. 46

ELECTROSTATIC SPRAY PAINTING—Ransburg Electro-Coating Corporation, Indianapolis, Ind. 15-page catalogue describing and illustrating the company's No. 2 process for electrostatic spray painting. 47

INSTALLATION ACCESSORIES—J. N. Fauver Co., Inc., Detroit, Mich. Catalogue 17-E, giving complete information on the company's installation accessories for lubrication, hydraulic, steam, liquid, and air applications. 48

DUST COLLECTOR—Research-Cottrell, Inc., Bound Brook, N. J. Bulletin 100, describing the company's Cyclo-trell multiple-tube dust collector which operates on centrifugal collection principles. 49

HYDRAULIC PUMP-MOTOR—Gerotor May Corporation, Baltimore, Md. Catalogue G-112, describing the company's types PMB 1.5-MB 1.5 hydraulic pump-motors. Specification charts are included. 50

CARBIDE BLANKS—Besly-Welles Corporation, South Beloit, Ill. Catalogue 851C, listing a wide range of carbide blanks for every cutting need. Prices, sizes, styles, and shapes are included. . 51

BED TYPE MILL—Motch & Merryweather Machinery Co., Cleveland, Ohio. 10-page catalogue describing the company's Mill-M-Matic bed type mill featuring automatic electrical control. 52

O-RING TUBE FITTINGS—Lenz Co., Dayton, Ohio. Folder describing the company's O-ring tube fittings that eliminate flaring, threading, welding and soldering. 53

LATHES—Logan Engineering Co., Chicago, Ill. 24-page catalogue describing the company's range of lathes and shapers, as well as accessories. A price list is included. 54

CORROSION - RESISTANT PROCESS EQUIPMENT—Pfaudler Co., Rochester, N. Y. Bulletin 936, covering the company's corrosion-resistant process equipment and serving as Buyer's Guide. . . 55

METAL-CUTTING TOOLS—Haynes Stellite Co., a Division of Jnion Carbide and Carbon Corporation, Kokomo, Ind. 16-page catalogue describing the company's metal-cutting tools. 56

WELDING POWER SOURCES—Lincoln Electric Co., Cleveland, Ohio. Catalogue SB-1358, illustrating and describing power sources for automatic welding applications. 57

DIE-CASTING MACHINE—Cuyahoga Industries, Cleveland, Ohio. Folder describing the company's Wedgelock die-casting machine with positive locking. 58

STORAGE RACKS—American Metal Products Co., Detroit, Mich. Catalogue giving information on the company's entire line of storage racks. 59

AUTOMATIC PLATING MACHINES—Udylite Corporation, Detroit, Mich. Folder describing the company's fully automatic plating machines. 60

PRODUCTION LATHE — Reed-Prentice Corporation, subsidiary of Package Machinery Co., Worcester, Mass. Illustrated folder describing the company's "Reedmatic" production lathe. 61

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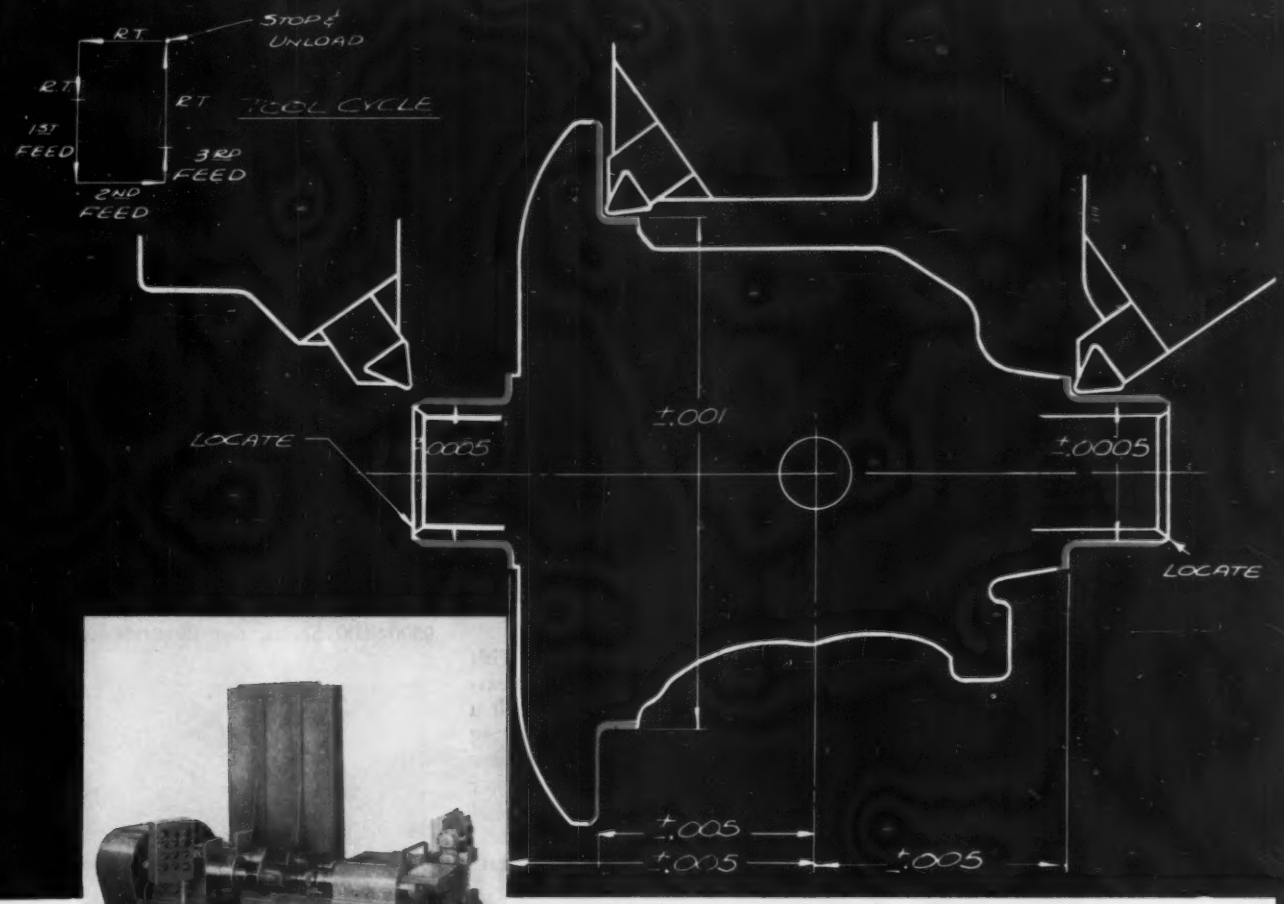
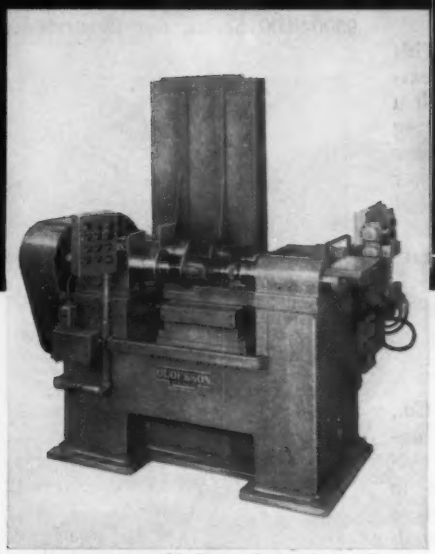
Please print your name and address

NAME .....
TITLE .....
COMPANY .....
CO. ADDRESS .....
CITY ..... ZONE ..... STATE .....

This card is void after December 1, 1956 M-9/56





Olofsson Special two-Station Precision Lathe.

Close-up view of differential cases clamped into position.

IT FIGURES!

For Your TOUGH Production Problems, Olofsson SPECIAL Machinery . . .

For example, this *2 Station Precision Lathe* can finish face and turn two hubs, and finish face and turn the flange on an automobile differential case, cast of cylinder iron, *at the rate of 60 per hour.* This production is possible because the design reduces operator fatigue and human error, provides push button operation.

Here's How It Works . . . The operator inserts a dog driver bar into the part, loads both stations of the machine and pushes the combination clamp, start-cycle button. That's all there is to it until the parts are ready for unloading.

For low tool replacement costs and quick change, the new type throw-away carbide cutting tool inserts are used. The lathe conforms to J.I.C. electrical and hydraulic standards.

If the cost of any phase of your machining operation is running too high . . . or if output is lagging . . . consult with Olofsson. You'll find it pays to "Special-ize" with Olofsson Special Machinery.

Today, put the Olofsson Engineering department to work for you. A letter or phone call will do it.

THE OLOFSSON CORPORATION

2729 Lyons Avenue, Lansing, Michigan

Manufacturers of Special and Automation Machinery, Standard-Index Tables, Drill Units, and Precision Boring Machines.

Bijur High-Temperature Lubricating Systems

Centralized, fully automatic lubricating systems designed to withstand temperatures up to 500 degrees F. have been announced by the Bijur Lubricating Corporation, Rochelle Park, N. J. The valves and filters of these systems combine heat-resistant qualities with the desired filter and flow control characteristics. Special lubricants have also been developed for use with the new systems.

A sintered bronze, high-temperature filter used in the pump mechanism of an automatic lubricator is shown in Fig. 1. Oil drawn up from a reservoir is thoroughly filtered by this porous sintered bronze disc which fits inside the pump. A snap-ring holds the filter in place, and a silicone rubber O-ring above it prevents oil from flowing around the filter.

A small tablet-shaped, high-temperature filter and the meter unit in which it is installed are illustrated in Fig. 2. This filter is also of porous bronze and is resistant to high temperatures.

A Bijur Type "P" automatic lubricator is shown in Fig. 3. This cyclic type lubricator feeds measured quantities of oil through a distribution system to lubricating points on a predetermined time cycle. High-temperature meter units measure and filter the oil at each point.

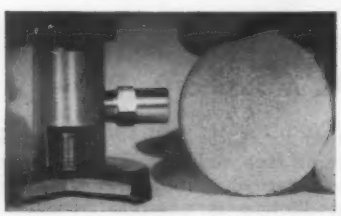


Fig. 1. Sintered bronze, high-temperature filter employed in Bijur automatic lubricator

Fig. 2. Bijur high-temperature filter and meter unit

Fig. 3. Bijur cyclic type lubricator for feeding measured quantities of oil

Circle Item 148 on postcard, page 231

Logansport Hydraulic Cylinders and Control Valves

The Logansport Machine Co., Inc., Logansport, Ind., has announced a line of hydraulic cylinders of the design shown in Fig. 1. These cylinders, known as Logan "Super-Matic," are available for operating pressures up to 2000 pounds per square inch in seven bore sizes ranging from 1 1/2 to 6 inches. The maximum stroke capacity is 72 inches. Five mounting styles with interchangeable covers permit multiple mounting combinations. The front and blind-end covers are of heavy steel plate.

The piston-rods are made of highly polished steel to assure minimum friction and maximum packing life. They are available in either standard or heavy-duty sizes in both male and female types. Cylinder tubes are hard-drawn and corrosion-resistant. Ports are unobstructed and can be relocated to any 90-degree position by rotating cylinder covers.

The company has also announced a line of hydraulic control valves of the type shown in Fig. 2, identified as the Logan 9700 Series. These valves are designed to meet JIC specifications and operate at pressures up to 3000 pounds per square inch.

Other features include: spring return; open and closed center type spools; two- and three-position, four-way design; two-position, two- and four-way design; a range of sizes from 1/8 to 1 1/4 inches; low power consumption; dust-tight enclosures; full capacity throughport and main spool; high-tensile alloy iron bodies; internal or external pilot pressure and drain; and long-sealing surface.

Another line of hydraulic control valves identified as Logan 9500-9600 Series, not illustrated, is also announced for operation at pressures up to 1500 pounds per square inch. This line has heavy-duty continuous-service solenoids and is available in a range of sizes from 1/4 to 1 inch.

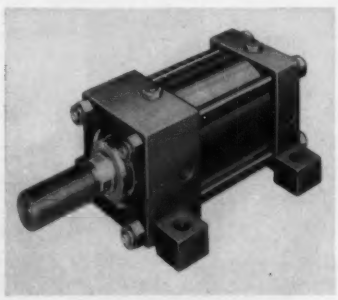


Fig. 1. Logansport "Super-Matic" hydraulic cylinder

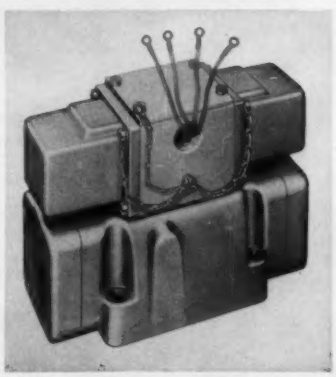


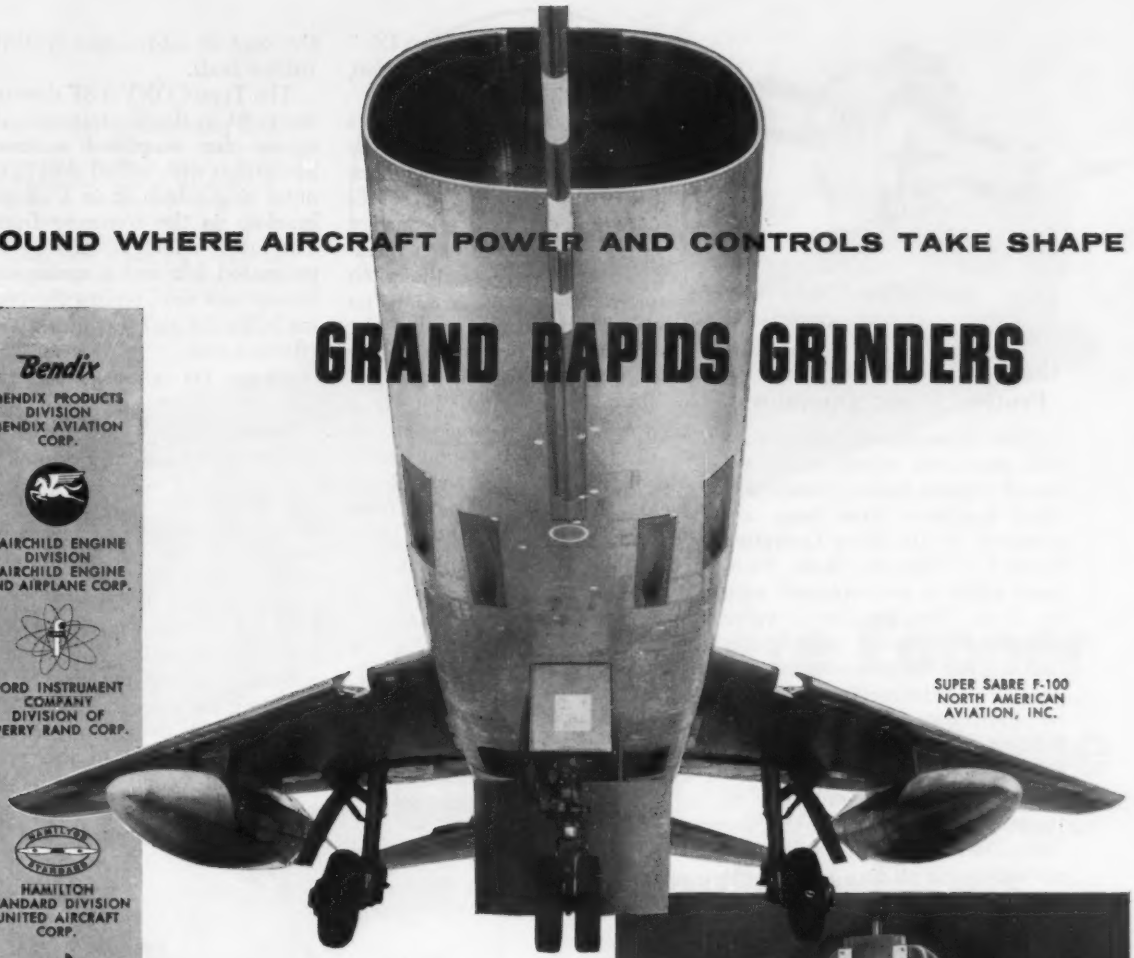
Fig. 2. Hydraulic control valve made by the Logansport Machine Co., Inc.

Circle Item 149 on postcard, page 231

(*Continued on page* 238)

FOUND WHERE AIRCRAFT POWER AND CONTROLS TAKE SHAPE

GRAND RAPIDS GRINDERS



SUPER SABRE F-100
NORTH AMERICAN
AVIATION, INC.

Bendix
BENDIX PRODUCTS DIVISION
BENDIX AVIATION CORP.

FAIRCHILD ENGINE DIVISION
FAIRCHILD ENGINE AND AIRPLANE CORP.

FORD INSTRUMENT COMPANY
DIVISION OF SPERRY RAND CORP.

HAMILTON STANDARD DIVISION
UNITED AIRCRAFT CORP.

LEAR, INCORPORATED

ORENDA ENGINES LIMITED

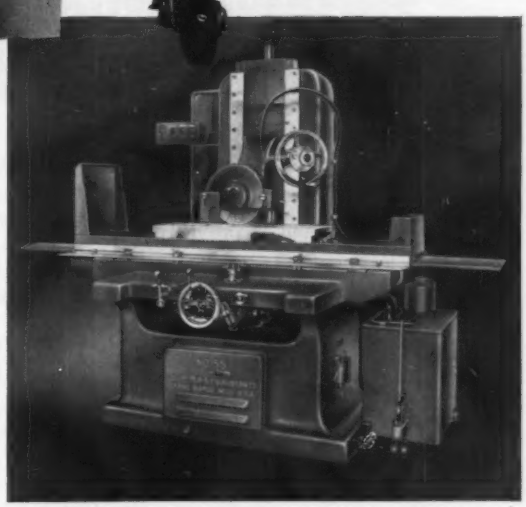
PRATT & WHITNEY AIRCRAFT
DIVISION OF UNITED AIRCRAFT CORP.

WRIGHT AERONAUTICAL DIVISION
CURTISS-WRIGHT CORP.

Precision is paramount in the manufacture of components for aircraft power and control. That's why these makers of precision parts have Grand Rapids Grinders in their toolrooms — for the utmost in precision grinding.

Model No. 55, for example, features one-piece column and base for permanent vibrationless rigidity. Longitudinal travel table and cross feed are hydraulically actuated. Wheel head has powered rapid vertical travel. And it's faster than any other grinder of this type and size . . . with variable table speed up to 125 fpm.

With these built-in precision features typical of all Grand Rapids Grinders, it's no wonder they're found in leading toolrooms.



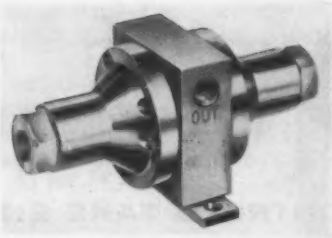
GRAND RAPIDS NO. 55 HYDRAULIC FEED SURFACE GRINDER. Table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head is 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1925 and 2500 rpm.

A note on your letterhead will bring full details.

GALLMEYER & LIVINGSTON

GALLMEYER & LIVINGSTON COMPANY

305 Straight Ave., S.W., Grand Rapids, Michigan



Ross "Non-Tie-Down" valve for protection of press operators

Control Valves Designed to Protect Press Operators

Pilot valves developed to provide two-hand safety for operators of presses, brakes, shears, and other machines have been announced by the Ross Operating Valve Co., Detroit, Mich. Two-hand safety is accomplished with the Ross "Non-Tie-Down" valve interposed between two palm-button type three-way valves in parallel and the receiver that is to be alternately pressurized and exhausted.

If the machine operator engages or disengages only one of the pair of palm-button valves, the "Non-Tie-Down" valve will automatically cut off any subsequent air flow through itself to the receiver. Re-cocking of the latter valve for safe two-hand operation can then be accomplished only by releasing the engaged pilot valve. To permit a reasonable delay between engagement of the two palm valves, a tamper-proof integral adjustment is provided.

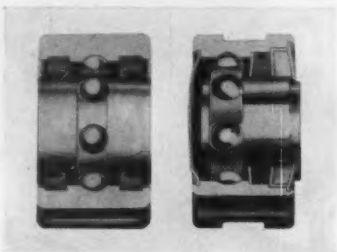
Circle Item 150 on postcard, page 231

Plug Gage for Setting and Checking Ring Thread Gages

A truncated plug gage for accurate setting and gaging of ring type thread gages has been announced by the Besly-Metro Division, Besly-Welles Corporation, South Beloit, Ill.

The truncations on these gages extend one-half the length on the major diameter of both members. The remaining portions are full-form. Pitch diameter is constant for the full length of each member. The tolerance on the pitch diameter of the gage is minus on the "Go" end and plus on the "Not Go" end. The ring gage to be checked is first set to the full-form portion of the setting plug. It is then moved to the truncated section of the plug for instant checking of wear or correctness at the pitch diameter. Sizes range from No. 0 to 1 1/2-inch threads.

Circle Item 151 on postcard, page 231



Conveyor roll bearings developed by Marlin-Rockwell Corporation

M-R-C Conveyor Roll Bearings

The Marlin-Rockwell Corporation, Jamestown, N. Y., is producing a line of ball bearings designed specifically for belt conveyor rolls. These bearings can be used for both inboard and outboard mountings.

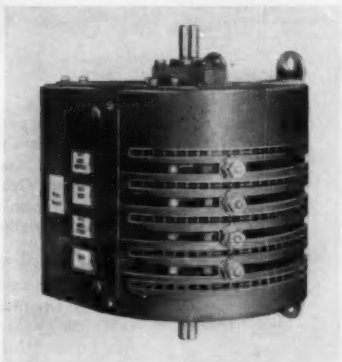
The Type CONV-3-J shown at the left in the illustration is an inboard design developed for mounting directly in the roller. This style is equipped with positive contact, oil-resistant synthetic rubber seals.

The Type CONV-3-SF shown at the right in the illustration is designed for simplified outboard mountings with milled slots in the outer ring which fit in U-shaped brackets in the conveyor frame. The metal shield, backed by impregnated felt and a spring-controlled cork seal, retains the bearing lubricant and provides a very effective seal.

Circle Item 152 on postcard, page 231

Rotary Cam Limit Switch for Mechanical Presses

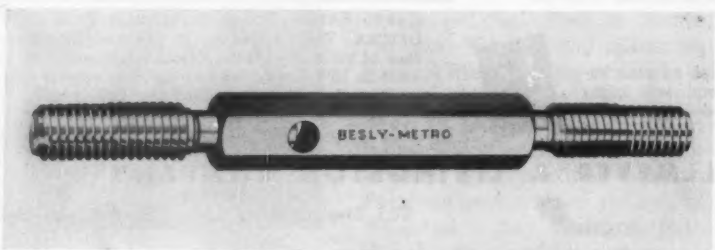
A rotary cam limit switch for mechanical presses has been announced by Danly Machine Specialties, Inc., Chicago, Ill. This switch permits fast external adjustment of the cams while the press is in operation, thus, it is unnecessary to stop the press while adjusting the timing of either the press controls or auxiliary equipment synchronized to the press cycle. Split-second timing of the control circuits is made through an adjustment of each cam by setting a thumb-screw on the outside of the housing.



Danly switch for mechanical press

The switch illustrated holds up to four cams. A larger size is available which holds up to twelve cams. A drive failure circuit can be employed which will stop operation of the main equipment should mechanical failure of the switch drive occur. This feature prevents damage to the press auxiliary equipment synchronized to the switch circuits.

Circle Item 153 on postcard, page 231



Besly-Metro truncated setting plug gage

REVERE COPPER EXTRUSION shown attached to skirtboard before full assembly, which you can see below in exploded view. A matching bar, similar to the one shown is part of the "packaged" HANCO unit and is fastened to the opposite side of the screen. Units, in turn, are installed on the various types of Vibrating Screens made by HEWITT-ROBINS INC., Passaic, N. J., and are known as the HEWITT-ROBINS HANNON Electric Screen Heaters.

CLOSE-UP showing end of the Revere Copper Extrusion.

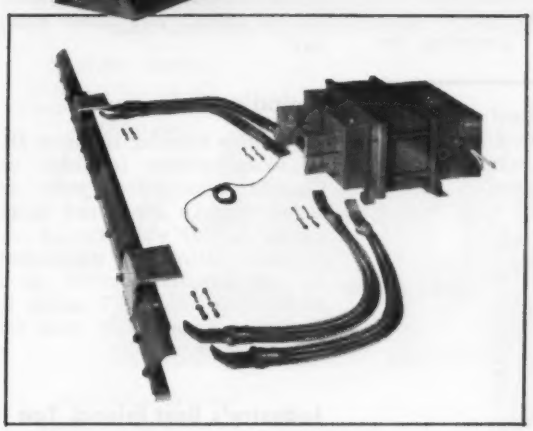
Revere Copper Extruded Shape

in Hanco Electric Screen Heater

out-performs

former copper casting

on 4 counts



"Customers of F. R. Hannon & Sons are now assured of many years of maintenance-free performance plus improved products."

Says T. W. HANNON, *Vice-President, General Manager*
F. R. HANNON & SONS, Canton, Ohio

Mr. Hannon continued, "For a number of years we had experimented with many different types of materials which would be non-porous, free from any burrs or voids, capable of maintaining a straight leading edge and able to carry 1500 amperes at 5 volts. The Revere Copper Extrusion meets these requirements. And for the rugged use to which our machines are put it would be virtually impossible to maintain satisfactory operating results without the use of this extruded electrical conductor."

Perhaps there is a Revere Product that can help you give *your* customers a superior product, or help cut your production costs. You'll never know until you call the Revere Office nearest you and ask to have a T. A. (Technical Advisor) call. Why not make that call today?

Here's the Score!

COPPER EXTRUDED SHAPE	COPPER CASTING
1—12 foot mill lengths offer flexibility, eliminating both welds and scrap	1—60" casting required additional welded joints
2—Shape offers lack of porosity	2—Casting gave porosity problem
3—Shape straightness is superior to casting, giving better electrical contact	3—Bow in casting presented difficulty when fastening screen firmly to contact
4—Higher cost per foot, but cheaper over-all installation	4—Initial cost was lower, but additional welds and scrap resulted in higher final cost, and an inferior finished product

REVERE COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y.

Sales Offices in Principal Cities, Distributors Everywhere.

COPPER * BRASS * 18 01 * REVERE * ALUMINUM

Between Grinds

By E. S. Salichs

The Big Blow

In a rock-crusher plant, the rock being dug in the quarry was coming up with much debris from tree roots, but a newly purchased washing machine was removing only 75 per cent of the roots. So the chief engineer was called in. While watching the operation, a stiff breeze came up, which seemed to be helping remove the residue. Accordingly, the engineer obtained an airplane propeller, rigged it up with a motor, and had it aimed at the rock being fed to the crusher, with satisfying results.

Plight Versus Flight of the Bumblebee

Victor Brook & Son, Rochester sales engineers, circulated this sermon-in-stone fact in some promotional literature: "According to theory of aerodynamics, and as may be readily demonstrated through laboratory tests and wind tunnel experiments, the Bumblebee is unable to fly. This is because the size, weight, and shape of his body, in relation to the total wing spread, make flying impossible. BUT: The Bumblebee, being ignorant of these profound scientific truths, goes ahead and flies anyway—and manages to make a little honey every day!"

RED-LETTER DAY FOR RED RING SHAVER—Genial Walter S. Praeg, president of the National Broach & Machine Co., Detroit, Mich., is seen here standing next to the 2000th Red Ring rotary gear-shaving machine manufactured by the company.

Melodies in Motion

Motorists enjoying Highway Hi-Fi record players (available on Chrysler automobiles) prefer to choose popular tunes and sentimental ballads when buying additional platters to supplement the six sets they receive as a starter. The records, 7 inches in diameter, are especially made for automobile use.

Industry's Best Friend, Too

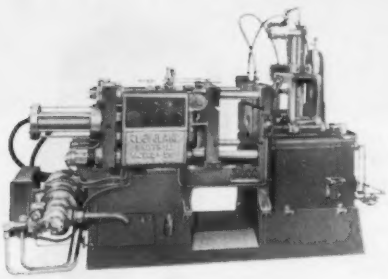
M-diamonds (Man-made diamonds, not M-m-m, diamonds) are of strategic, commercial, and scientific interest, tool engineers were told at a recent meeting. J. S. Gillespie, manager of the industrial diamond project at G.E.'s Metallurgical Products Department, outlined his three sets of reasons for this interest, and they all carry weight—12,000,000 carats yearly.

Magazine Hopping

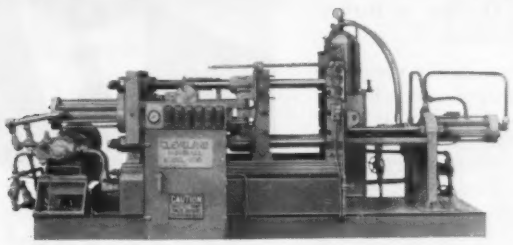
Our Editor, Charles O. Herb, "guested" *Industrial Marketing* in February with an article entitled "How Much Editorial is Staff Written?" It aroused much favorable comment, as well as being reprinted by *Plant Engineer*.

your answer to Profitable die casting production

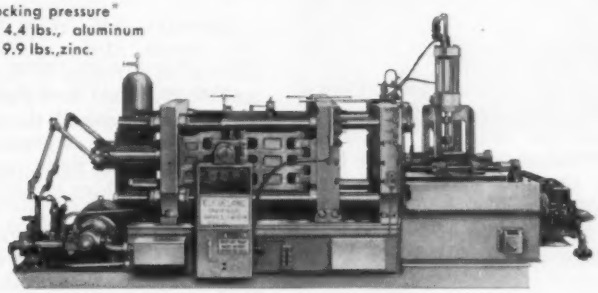
CLEVELANDS



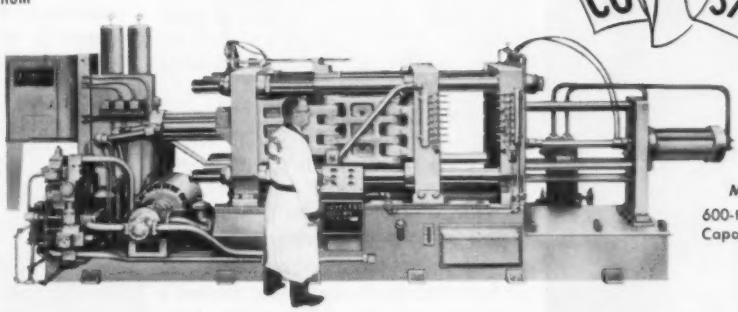
Model 50 Cleveland
50-ton locking pressure*
Capacity: 2.6 lbs., aluminum
5.4 lbs., zinc



Model 200 Cleveland
200-ton locking pressure*
Capacity: 4.4 lbs., aluminum
9.9 lbs.,zinc.



Model 400N Cleveland
400-ton locking pressure*
Capacity: 7.2 lbs., aluminum
14.5 lbs., zinc.



Model 600 Cleveland
600-ton locking pressure*
Capacity: 10 lbs., aluminum
25 lbs., zinc.

*Locking pressure strain gage tested.

Shown here are several models in the line of Cleveland Universal Hydraulic Die Casting Machines...each one a champion in its class! Whether the casting size is large or small, there's a Cleveland that will fit your production requirements exactly and give you castings of precision quality at a highly profitable rate.

The nation's leading die casters rely on Clevelands for dependable performance. Find out now how Clevelands can improve your die casting production with money saved. Call in a Cleveland sales engineer. For complete machine specifications, write for bulletins.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4936 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

For more information fill in page number on Inquiry Card, on page 231

News OF THE INDUSTRY

Illinois and Indiana

SCULLY-JONES & Co., Chicago, Ill., announce appointments of the following distributors: SERVICE INDUSTRIAL, 4118 University Ave., San Diego, Calif.; EKEDAHL TOOL & SUPPLY CO., Library Road and Milford Drive, Pittsburgh, Pa.; POCATELLO PLUMBING & INDUSTRIAL SUPPLY, INC., 1921 N. Harrison, Pocatello, Idaho; MCKEE TOOL & SUPPLY CO., 925 N. Jameson, Lima, Ohio; PEERLESS SUPPLY CO., INC., Shreveport, La.; and KENDALL INDUSTRIAL SUPPLY, 407 S. Fair Ave., Benton Harbor, Mich. These distributors will carry stocks of Scully-Jones drill and tap chucks, floating holders, adjustable adapters, quick-change chucks, standard milling machine arbors, lathe centers, and holding tools.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., has announced the purchase of property for a new steel service plant. A 14-acre tract just outside the eastern city limits of Indianapolis, Ind., has been purchased for that purpose.

LAWRENCE T. PEIFER, manager of business development for Borg-Warner Corporation, Chicago, Ill., has been appointed administrative vice-president of the corporation's Atkins Saw Division, Indianapolis, Ind.

Lawrence T. Peifer, newly appointed administrative vice-president, Atkins Saw Division

THOR POWER TOOL CO., Aurora, Ill., announces the following appointments: JOHN P. BANK has been appointed sales engineer; RICHARD E. JAMES, JR., has been named manager of the company's new Indianapolis branch to be opened this fall. Announced is also the opening of a branch office at 3911 W. Greenfield Ave., Milwaukee, Wis.

H. H. KIECKHEFER has been appointed sales manager of the Wheelco Instruments Division of Barber-Colman Co., Rockford, Ill.

RANSBURG ELECTRO-COATING CORPORATION, Indianapolis, Ind., has announced plans for a $1,000,000 building and expansion program. Construction of a single-story, 8000-square-foot building, to be located at 4000 W. 56th St., Indianapolis, will get under way this year and is expected to be completed late in 1957.

Michigan

VICKERS INCORPORATED, Detroit, Mich., announces the following appointments: ROBERT THOREN was made district manager for the Rockford, Ill., area. CHARLES W. NEWMAN was appointed manager of the company's northwest branch. In his new position, Mr. Newman will have offices in Seattle, Wash.

RICHARD H. MELVIN has been appointed sales manager for Sahlin Engineering Co., Inc., Birmingham, Mich. He will be located at the main offices in Birmingham and will be responsible for sales in the United States and Europe.

WESSON MULTICUT CO. is erecting a new plant in Brighton, Mich., to meet the demands for its special tools in automated industries. No standard tools will be produced at the new plant.

WICKES MACHINE TOOL DIVISION, Saginaw, Mich., has made known a change of the firm's name from Wickes Brothers. At the same time, the following appointments were announced: JOSEPH A. OEMING was named sales manager of the division and R. T. LOUDON was made Detroit district manager—the position formerly held by Mr. Oeming.

Charles H. Crawford, a vice-president of Colonial Broach & Machine Co.

COLONIAL BROACH & MACHINE CO., Detroit, Mich., announces the election of CHARLES H. CRAWFORD and W. W. WOOD as vice-presidents. Mr. Crawford joined the company several years ago as plant manager after more than thirty years with Mack Truck, where he held various manufacturing posts. Mr. Wood is general manager of Colonial Bushings, Inc., an affiliate of the company.

ACHESON COLLOIDS CO., Port Huron, Mich., has announced the appointments of E. RALPH EGLOFF and FRANK H. MROZEK as service engineers. Mr. Egloff has been assigned to the Chicago sales office of the company, while Mr. Mrozek will be located in the company's New York office.

MARLIN R. HEMPHILL has been appointed general manager of the Forging and Casting Division of Allegheny Ludlum Steel Corporation, Ferndale, Mich. Mr. Hemphill is now general manager of the company's Carmet Division and will retain his existing position along with his new duties.

MICROMETRICAL MFG. CO., Ann Arbor, Mich., announces the following promotions: FRITZ A. ZANDER

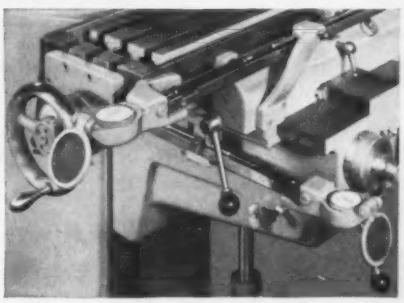
Toolmaster Attachments

Stretch Toolmaster Versatility *Over More Jobs*

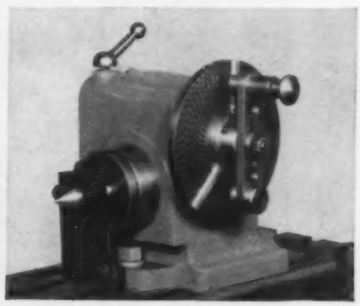
. . . and give you an opportunity to reduce the cost of dozens of machining operations performed on CINCINNATI Toolmaster Milling Machines. Six of these attachments are illustrated here. You will find others just as profitable for your toolroom in the following list:

- **Power feed to table**
- **Power feed to saddle**
- **6" extra table traverse**
- **Shaping attachment**
- **Shaping tools**
- **Precision measuring equipment** (longitudinal, cross, vertical, or combinations)
- **Overarm adapter** (intermediate swivel)
- **Vises**
- **8" index head and tailstock**
- **Quill feed for 1C machine**
- **Cutter illuminating attachment**
- **Cutting fluid pump**
- **Straight cylindrical collets** (inch and metric sizes)
- **Taper hole collets**
- **Adapter for small collets**
- **Adapter for straight shank cutters**
- **Drill chucks**

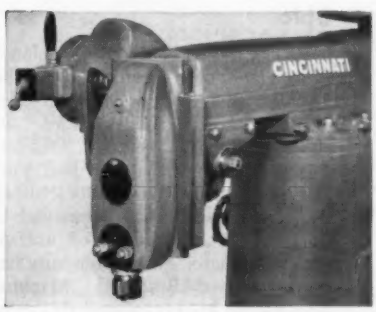
Two Toolmaster attachments are shown above:
1) Swivel Vise, 2) Cutter Illuminating Attachment



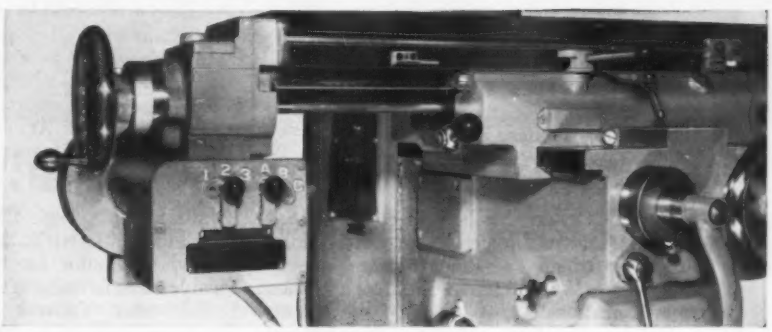
Precision Measuring Equipment



Index Head



Shaping Attachment



Power Feed to Table

Our representative will be glad to tell you more about Toolmaster versatility, its rugged construction, and the fine array of attachments. Write to him today and ask for the latest Toolmaster catalog No. M-1870-3.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

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was elected executive vice-president, and FRANK W. KABAT, director of sales.

EDWARD J. EGGART was recently elected president of Vinco Corporation, Detroit, Mich. Mr. Eggart succeeds E. E. BUTLER, who becomes chairman of the board of directors.

GEORGE C. WILSHER has been appointed vice-president in charge of engineering of Holcroft & Co., Detroit, Mich. Mr. Wilsher joined the company in 1925. Since then he moved up through the shop, engineering department, field erection, sales, and since 1945, has headed Holcroft's engineering department.

George C. Wilsher, vice-president in charge of engineering at Holcroft & Co.

CHESTER S. JOHNS has been named to the newly created post of sales manager for standard machines and products of The Cross Company, Detroit, Mich.

JOHN D. GORDON has been elected vice-president and general manager in charge of all operations of the Progressive Welder Sales Co., Detroit, Mich.

DOW CHEMICAL CO., Midland, Mich., announces expansion of its finishing and cathodic protection services for users of magnesium.

New England

ALLAN S. ROBERTSON has been appointed vice-president in charge of sales of Fenwal, Inc., Ashland, Mass. In his new position, Mr. Robertson will be responsible for the company's over-all domestic and export marketing and sales program.

VAN NORMAN INDUSTRIES, INC., Springfield, Mass., has arranged to acquire 17,128 shares of the American Pulley Co.'s common stock, thereby becoming that company's largest single stockholder.

ADVANCE BEARING & SUPPLY CO., INC., Worcester, Mass., has been appointed distributor for the Formsprag Co., Van Dyke, Mich.

GEORGE ULLRING has been appointed assistant sales manager of the Allen Mfg. Co., Hartford, Conn. In this new capacity, he will have charge of the field sales force. Mr. Ullring has been the company's sales representative in the Cleveland and Pittsburgh areas for twenty years.

BROWN & SHARPE MFG. CO., Providence, R. I., and NELCO TOOL CO., INC., Manchester, Conn., have announced combined sales operations to afford "on-the-spot" delivery of more than 3000 standard carbide, carbide-tipped, and high-speed steel metal-cutting tools and accessories through Brown & Sharpe-Nelco distributors. In addition to their standard lines, both Brown & Sharpe Mfg. Co. and Nelco Tool Co. will continue to produce special tools for specific applications where needed.

New York and New Jersey

RUSSELL, BURDSALL & WARD BOLT AND NUT CO., Port Chester, N. Y. has announced the appointments of JAMES M. DILL, JR., as assistant to the vice-president of sales and WARD K. JONES as assistant office sales manager. Both men have been with the company since 1946. Also, RUSSELL E. HOEHL has been named assistant eastern sales manager and ALFRED A. BINKERD, district sales manager of the Philadelphia territory.

SABRE STEEL SERVICE, INC., 4560 Bailey Ave., Buffalo 21, N. Y., has been appointed distributor for the Vulcan-Crucible Steel Division in the greater Buffalo area. THOMAS H. NORSEN has been assigned as Vulcan's mill representative to work with Sabre Steel Service, Inc. to assist them in the application service of Vulcan tool steels.

JOSEPH J. JAKLITSCH, JR., has been named acting editor by the American Society of Mechanical Engineers, New York City. Mr. Jaklitsch, who now holds the post of associate editor, has been on the editorial staff of the Society since 1945. He succeeds GEORGE A. STETSON, who becomes editor emeritus.

GENERAL ELECTRIC CO.'s Medium Induction Motor Department has announced a $2,000,000 expansion in Schenectady, N. Y. for the manufacturing and testing of "canned motor" and electromagnetic pumps for the atomic industry.

ROBERT GRAVES HESS has been elected executive vice-president of the Walworth Co., New York City. Mr. Hess was formerly executive vice-president of Pesco Products Division, Borg-Warner Corporation.

OPTO-METRIC TOOLS, INC., 15 Park Row, New York City, is a newly formed firm specializing in domestic and foreign optical measuring tools. FRITZ KOENIG heads this company as president and general manager.

STANAT MFG. CO., INC., New York City, has begun construction of a single-story plant at Brush Hollow Road, Westbury, L. I., N. Y.

PAUL N. GILLON has been appointed manager of the Basic Research Branch of the Carborundum Company, Niagara Falls, N. Y. research laboratory.

AMERICAN ZINC INSTITUTE, INC. will occupy new and larger offices in Suite 2020, Lincoln Building, 60 E. 42nd St., New York City.

A. MILNE & CO., New York City, announce the opening of a branch office at 1635 Gent Ave., Indianapolis, Ind.

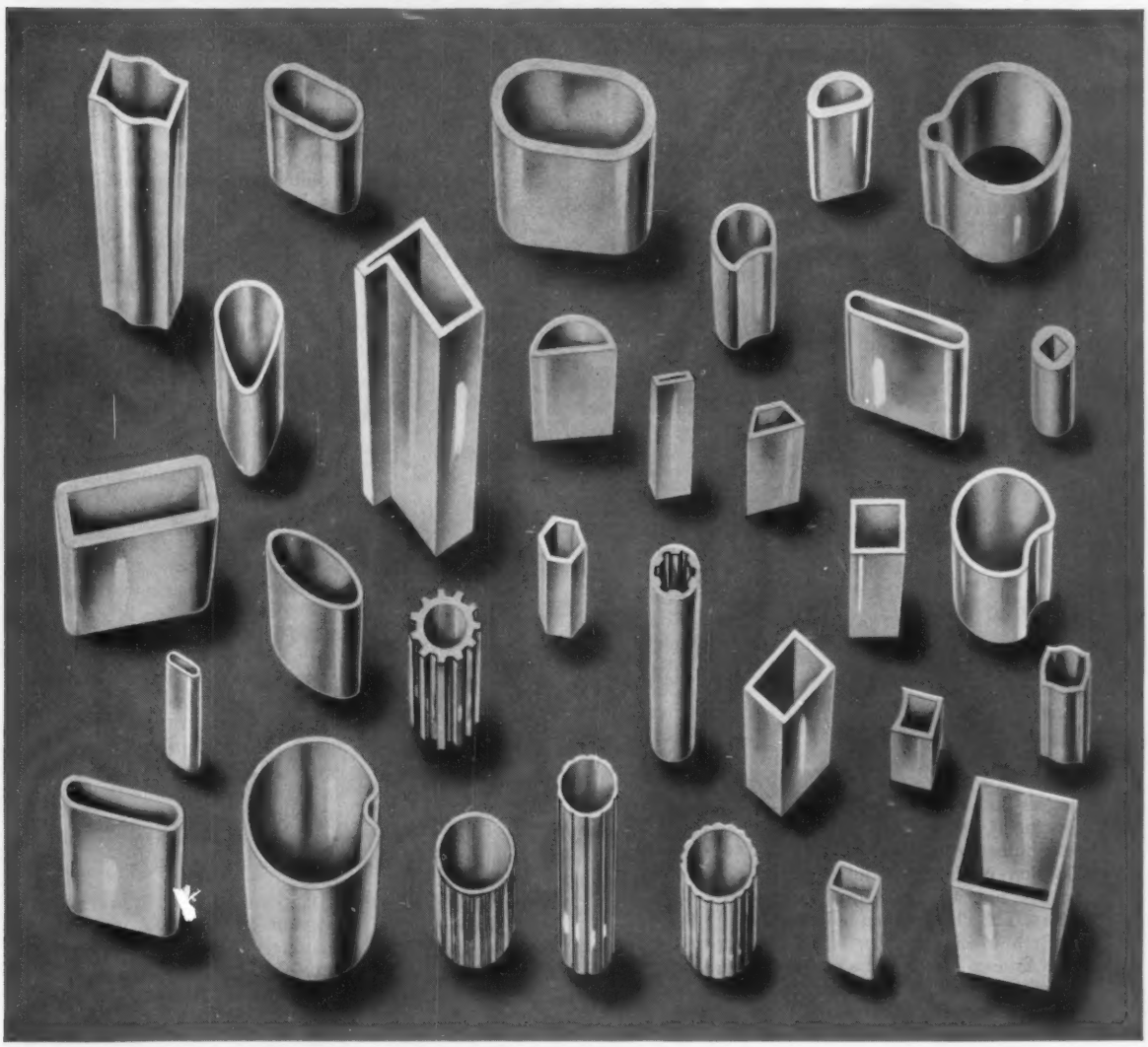
AUTOMATIC SWITCH CO., Orange, N. J., announces appointment of the Hydraulic Equipment Co., 5924 E. Olympic Blvd., Los Angeles 22, Calif., as stocking distributors of Asco solenoid valves.

Ohio

FRANK B. STALLINGS, Cleveland, Ohio, announces acquisition of the machine tool and pedestal grinder product lines of the Bradford Machine Tool Co., Cincinnati, Ohio. It was also stated that he had purchased part of the manufacturing facilities which would be moved to Lansing, Mich., to become a UNIVERSAL affiliate. A new company has been formed—Bradford Machine Tool Co. of Michigan—and this company will continue to manufacture lathe and pedestal grinders. R. B. MCDOWELL is vice-president of the new firm and will manage this affiliate.

(*Continued on page* 246)

A SHORT CUT TO A FINISHED PRODUCT



YOU NAME THE TUBE SHAPE AND THE METAL

Our specialized facilities and stock tools can save you time and money

Special-shape seamless tubes in straight lengths, or cut into short pieces, can save several steps in arriving at a finished product—can save you material and many direct labor costs. The American Brass Company's French Small Tube Division has turned out thousands of tubes in special shapes up to ¾" O.D. A variety of stock tools is available to save fitting-up charges.

For consumer products: Some special tubes are produced to the accepted commercial tolerances and finishes for such applications as electric fixtures, furniture ferrules, heat exchangers, radiator tubes, refrigeration controls, hardware, jewelry, automatic pencils, and a host of others.

High precision products: Many are made unusually accurate in I.D. and O.D. dimensions, with specially cleaned inside and outside surfaces, for parts for control instruments and for other scientific and industrial equipment.

Wide choice of metals: Special-shape tubes are available in copper, brass, bronze, nickel silver, special copper alloys, and aluminum – furnished in straight mill lengths or accurately cut to your specifications.

For action: See your American Brass Company representative or send in a sample, drawing, or description, together with the quantity you need, the metal, and other pertinent data. Address: The American Brass Company, French Small Tube Division, Waterbury 20, Conn.

ANACONDA®
SPECIAL-SHAPE TUBES

For more information fill in page number on Inquiry Card, on page 231

James F. Beré, general manager of Axelson Mfg. Co.

Howard W. Carlisle, general manager of Clearing, Hamilton, Ohio

HOWARD W. CARLISLE has been named general manager of the Hamilton, Ohio, plant of Clearing Machine Corporation, a Division of U. S. Industries, Inc. Mr. Carlisle succeeds JAMES F. BERÉ, whose appointment as general manager of the Axelson Mfg. Co. of Los Angeles, Calif.,—another division of U. S. Industries, Inc.—was also announced.

MCBETH MACHINERY CO., 106 Rogers Building, 1720 Section Road, Cincinnati, Ohio, has been appointed distributor by the Axelson Mfg. Co., Division of U. S. Industries, Inc., for its line of heavy-duty engine lathes. The Philadelphia office of the McBeth Machinery Co. will represent Axelson lathes and also the line of milling machines in eastern Pennsylvania, southern New Jersey, Delaware, and Maryland.

KING D. CHRISTOPHER has been named general manager of the newly established Los Angeles division of Clark Controller Co., Cleveland, Ohio. He has been district sales manager in Los Angeles since 1951.

SWIFT ELECTRIC WELDER CO. and OHIO MACHINE TOOL CO. have merged to form the Swift-Ohio Corporation with executive and sales offices in Detroit and plant in Kenton, Ohio.

HENRY H. PLATEK has been appointed advertising manager of the Cleveland Worm & Gear Co. and its affiliate, the Farval Corporation, Cleveland, Ohio.

E. W. BLISS CO., Canton, Ohio, has acquired ownership of JOHN ROBERTSON CO., INC., Brooklyn, N. Y. The Robertson Co. will be operated as a wholly owned subsidiary.

ROBERT S. DIENER has been appointed district sales supervisor of Coated Abrasives Division, Armour & Co., Alliance, Ohio. Mr. Diener will supervise sales in the northern section of Indiana.

LEO M. MONROE has been appointed manager of industrial equipment sales for the Brush Electronics Co., Cleveland, Ohio.

GORDON M. PIOTROWSKI has been named a district application engineer in the Chicago district office of the Clark Controller Co., Cleveland, Ohio.

A 20,000-square-foot plant addition has been completed by the SURFACE COMBUSTION CORPORATION, 2375 Dorr St., Toledo, Ohio.

NORMAN A. PRICE has been promoted to executive vice-president of the Colson Corporation, Elyria, Ohio.

ANDREW V. WETZEL has been named chief metallurgist for the Cleveland Cap Screw Co., Cleveland, Ohio.

Pennsylvania

STANDARD PRESSED STEEL CO., Jenkintown, Pa., has announced a long-range program of improvement of plants and facilities on both coasts and in England. The company has, therefore, created a new top management post—director of plant improvement—and named FRANK G. KAUFMAN to it. Mr. Kaufman, an expert on plant construction and equipment, is vice-president in charge of product engineering for the Cleveland Cap Screw Co., a Standard Pressed Steel subsidiary. At the same time, it was announced that SIDNEY A. MATTHEWS has been appointed to serve as machine tool analyst.

CARPENTER STEEL CO., Reading, Pa., announces the appointments of six men to managerial positions: RICHARD P. EVANS has been named assistant to the vice-president in charge of sales; ROBERT P. UHL has been named New York district manager; CHARLES E. MILLER has become branch manager of the Houston, Tex., area; O. T. THOMPSON has been appointed branch manager in the Detroit area; J. C. MURRAY was made assistant branch manager in the Pittsburgh area; and HARRY L. HIGH, JR., was made assistant branch manager of the Cincinnati area.

UNITED STATES STEEL CORPORATION, Pittsburgh, Pa., announces the appointments of HERBERT F. BYRNE as vice-president of production planning and of LOUIS J. ROHL as vice-president and chief metallurgical engineer. These are both newly created positions. At the same time, it was announced that JOSEPH M. GREER was promoted to general manager—production planning.

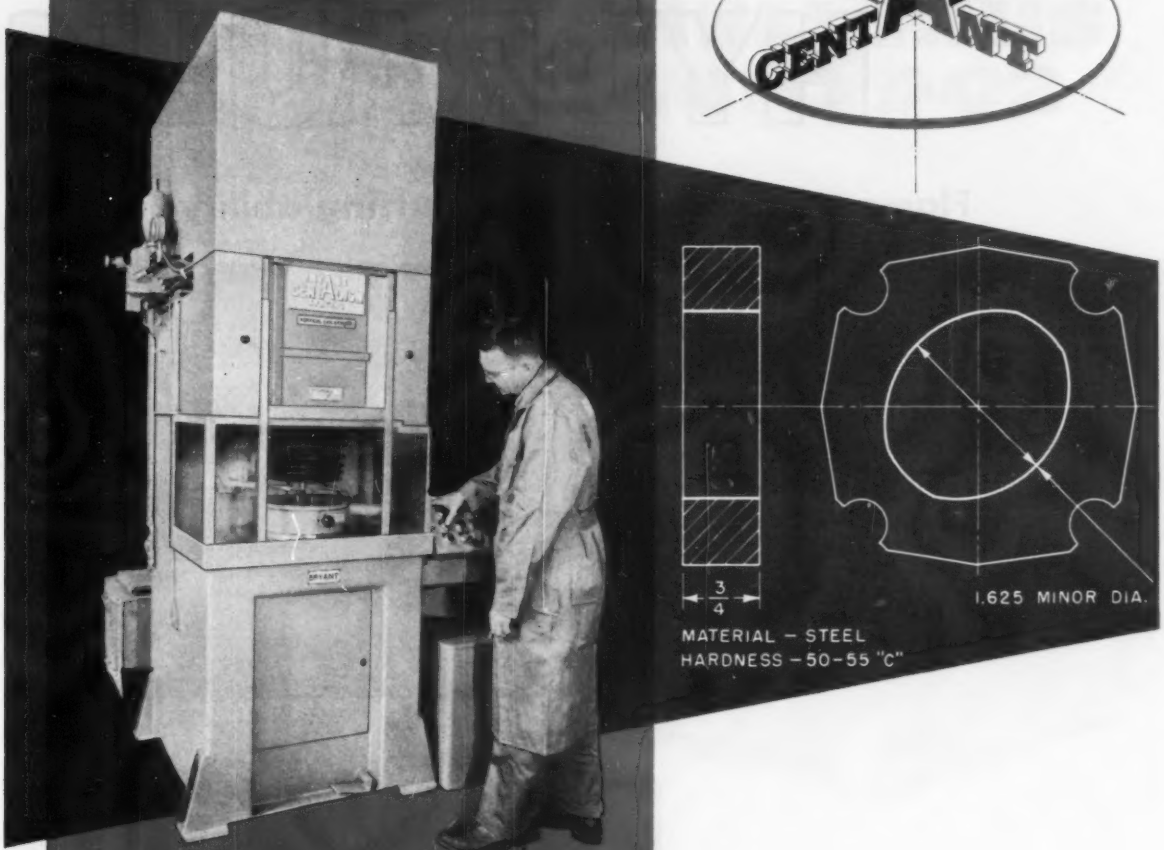
GEORGE A. SMITH has been appointed production manager of the materials handling division of the Yale & Towne Mfg. Co., Philadelphia, Pa. He came to the company from the International Business Machines Corporation, where he was manager of materials handling and packaging. Mr. Smith is a former national president of the American Materials Handling Society.

FIRTH STERLING, INC., Pittsburgh, Pa., has acquired the Yonkers, N. Y., research and laboratory facilities of the Schwarzkopf Development Corporation, formerly American Electro Metal Corporation. These facilities will be operated as the American Electro Metal Division, Firth Sterling, Inc.

VANADIUM-ALLOYS STEEL CO. announces an expansion program at its Latrobe, Pa., mill, which will approximately double the capacity of the entire plant. This mill will be exclusively devoted to the production of high-speed steel.

(*Continued on page* 254)

The New BRYANT Vertical Cam Grinder



Increases production up to 4½ times!

Like the standard "Centalign", this special vertical machine offers you tremendous savings in your grinding production.

A typical production job is the grinding of 2-lobed bores in hydraulic pump parts, at the rate of 130 to 140 pieces per hour. This compares with a production rate of 30 pieces per hour attained by previous methods. Work parts are hand-loaded into a special high-speed chuck, rotating at 100 RPM. Stock removal is .015 to .020.

The Bryant Vertical Cam Grinder does more work better, because it incorporates many important new features. For instance: greater rigidity and stability; faster stock removal and greater accuracy; workhead, wheelhead and longitudinal and cross slide motions of the wheelslide in one common plane; machine function controlled by programming cam sets which can be readily interchanged.

These and other features of the Bryant Vertical Cam Grinder assure you of a grinding efficiency rate never before attained.

Investigate today — ask for DETAILS!

BRYANT Chucking Grinder Co.

20 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers • Special Machinery

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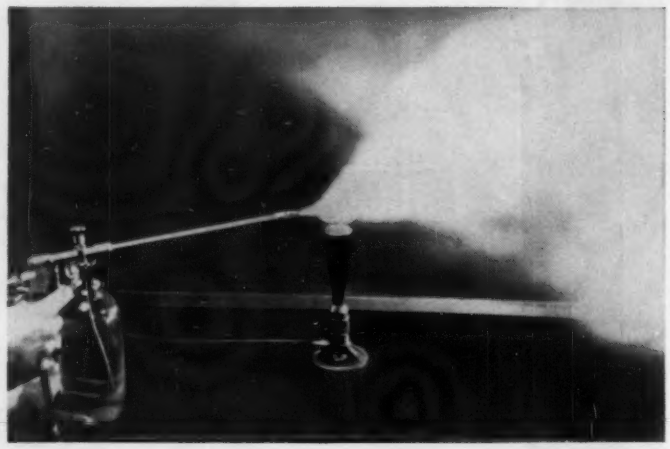
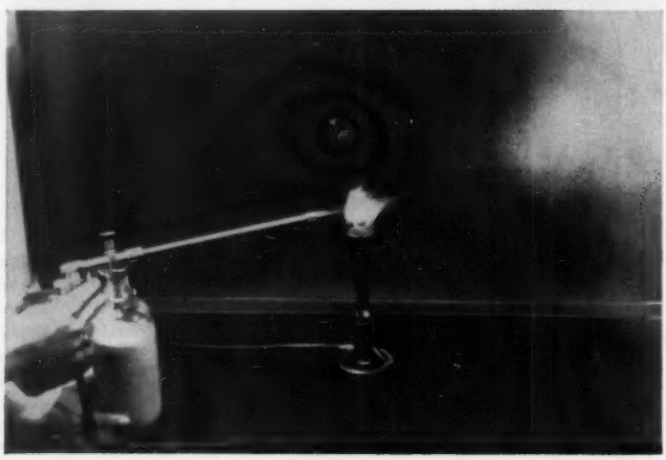
Announcing...the First

HYDRAULIC

Flame tests prove its fire-snuffing ability



This photo shows the instant combustion taking place when a conventional hydraulic oil of mineral oil type is atomized over a Bunsen burner.



In this photo, Shell Irus Fluid 902 replaces the mineral oil. Note that there is no ignition.

SHELL IRUS FLUID 902

Oil-Base fire-resistant FLUID

SHELL IRUS FLUID 902

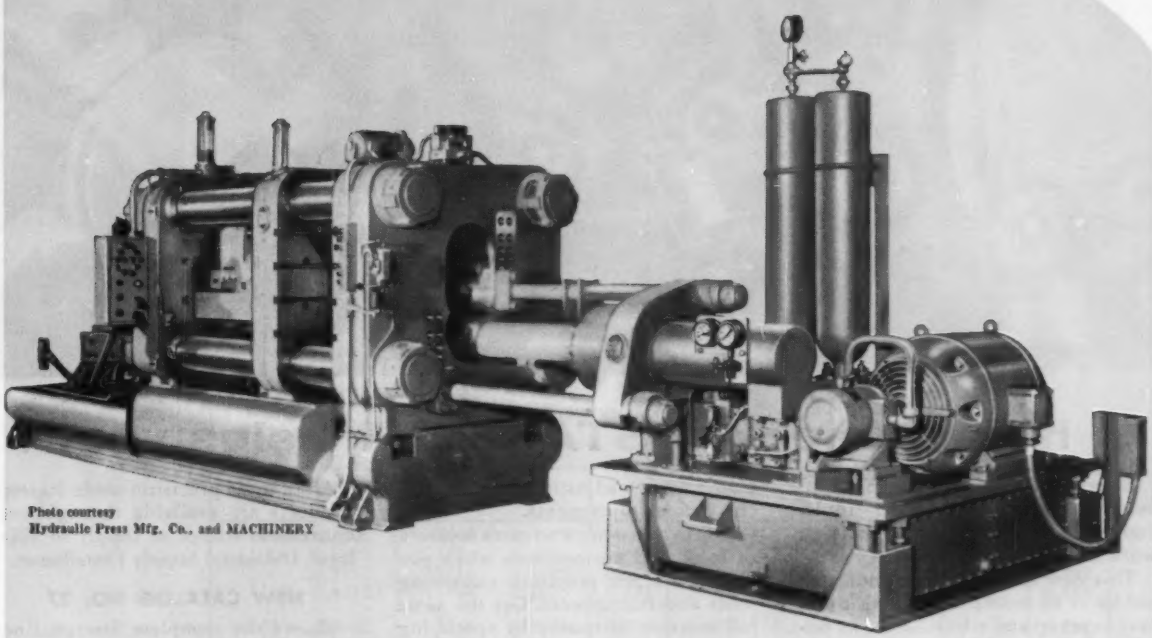


Photo courtesy Hydraulic Press Mfg. Co., and MACHINERY

AFTER THREE YEARS of intensive research, field application and evaluation, Shell Irus Fluid 902 is now commercially available for use in industrial hydraulic systems. While its cost is far lower than other fire-resistant fluids, its performance is comparable.

No major modification of equipment is necessary. Shell Irus Fluid 902 is a special formulation containing no corrosive ingredients . . . no adverse effect on seals or fittings. It is a direct replacement for hydraulic oils now in service.

Noncorrosive, and nonrusting. Steel and copper panels immersed in Irus Fluid 902 for one week at 160°F have shown no significant signs of corrosion. Rusting has not been a problem in long-continued field tests.

This is an efficient fire-snuffing hydraulic fluid that can be widely used. Send coupon for details.

SHELL OIL COMPANY

50 WEST 50 STREET, NEW YORK 20, NEW YORK

100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

SHELL OIL COMPANY
50 West 50th St. or 100 Bush St.
New York 20, N. Y. San Francisco 6, Cal.

Please send me test data and information on Shell Irus Fluid 902.

Name_____

Company_____

Address_____

_____

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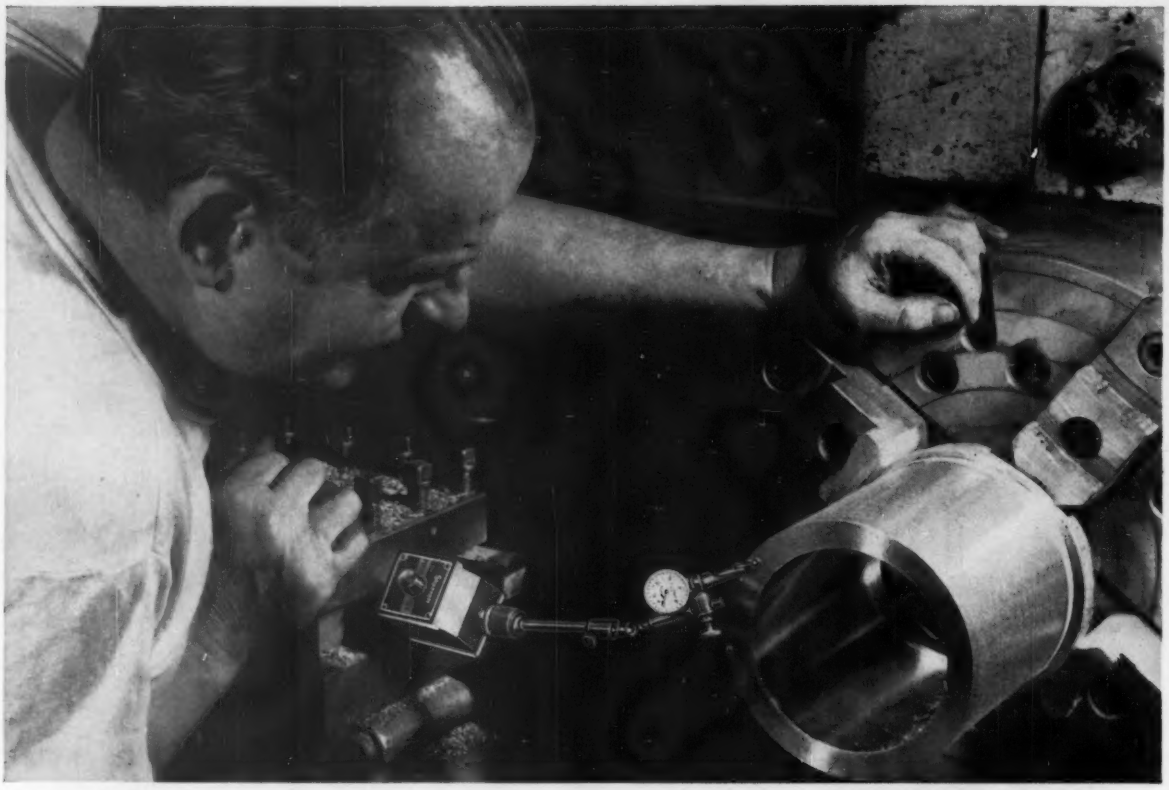

here's one way STARRETT helps you...

By constantly bringing out new and better precision measuring tools, Starrett helps you produce precision work faster and at less cost.

This new magnetic base indicator holder is an example. It's quick and easy to set up and adjust. It has an on-off push button which permits mounting the base with one hand, leaving the other free to position the indicator. It has universal adjustments including a fine adjusting screw for accurate final adjustments.

You expect *and get* an extra measure of value and performance when you specify Starrett precision measuring tools and instruments. Get the same full measure of quality by specifying *Starrett* when you buy dial indicators, steel tapes, hacksaws, hole saws, band saws, band knives, and precision ground die and flat stock.

All of these precision-made Starrett products are available through one convenient source of supply — your local Industrial Supply Distributor.

NEW CATALOG NO. 27

Shows the complete Starrett line. Ask your Industrial Supply Distributor or write for free copy. Address Dept. D, The L. S. Starrett Company, Athol, Mass., U. S. A.

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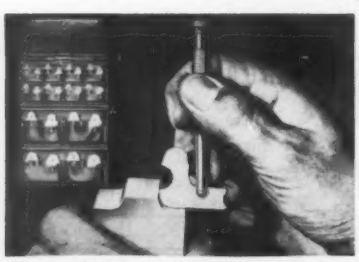
Starrett

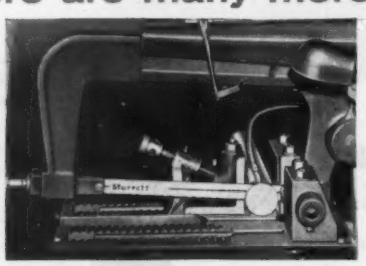
SINCE 1880
WORLD'S GREATEST TOOLMAKERS

MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

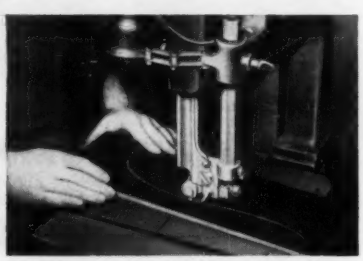
here are many more...



New No. 167 Radius Gages — made of rust-proof stainless steel with Satin Finish.



New Production-Proved Hacksaws are color-identified for job-match selection.



Precision ground Flat Stock and Die Stock — now available in over 1000 sizes.

SEE THE STARRETT EXHIBIT • SPACE 919 • NATIONAL METAL SHOW

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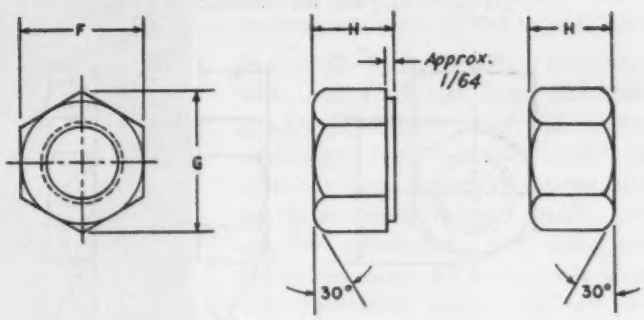
AMERICAN STANDARD FINISHED HEXAGON THICK NUTS



Nominal Size or Basic Major Diameter of Thread		Width Across Flats F			Width Across Corners G		Thickness H		
		Max. (Basic)		Min.	Max.	Min.	Nom.	Max.	Min.
1/4	0.2500	7/16	0.4375	0.428	0.505	0.488	9/32	0.288	0.274
5/16	0.3125	1/2	0.5000	0.489	0.577	0.557	21/64	0.336	0.320
3/8	0.3750	9/16	0.5625	0.551	0.650	0.628	13/32	0.415	0.398
7/16	0.4375	11/16	0.6875	0.675	0.794	0.768	29/64	0.463	0.444
1/2	0.5000	3/4	0.7500	0.736	0.866	0.840	9/16	0.573	0.552
9/16	0.5625	7/8	0.8750	0.861	1.010	0.982	39/64	0.621	0.598
5/8	0.6250	15/16	0.9375	0.922	1.083	1.051	23/32	0.731	0.706
3/4	0.7500	1 1/8	1.1250	1.088	1.299	1.240	13/16	0.827	0.798
7/8	0.8750	1 5/16	1.3125	1.269	1.516	1.447	29/32	0.922	0.890
1	1.0000	1 1/2	1.5000	1.450	1.732	1.653	1	1.018	0.982
1 1/8	1.1250	1 11/16	1.6875	1.631	1.949	1.859	1 5/32	1.176	1.136
1 1/4	1.2500	1 7/8	1.8750	1.812	2.165	2.066	1 1/4	1.272	1.228
1 3/8	1.3750	2 1/16	2.0625	1.994	2.382	2.273	1 3/8	1.399	1.351
1 1/2	1.5000	2 1/4	2.2500	2.175	2.598	2.480	1 1/2	1.526	1.474

All dimensions given in inches.

"Finished" in the title refers to the quality of manufacture and the closeness of tolerance and does not indicate that surfaces are completely machined.

Taper of the sides of nuts (angle between one side and the axis) shall not exceed 2 degrees, the specified width across flats being the largest dimension.

Tops of nuts shall be flat and chamfered. Diameter of top circle shall be the maximum width across flats within a tolerance of minus 15 per cent for washer-faced nuts and within a tolerance of minus 5 per cent for double-chamfered nuts.

Bearing surface shall be washer-faced or have chamfered corners. Diameter of washer face and the diameter of circle of bearing surface of double-chamfered nuts shall be the maximum width across flats within a tolerance of minus 5 per cent. Tapped hole shall be countersunk 1/64 inch over the major diameter of thread for nuts up to and including 1/2 inch, and countersunk 1/32 inch over the major diameter of thread for nuts over 1/2-inch size.

Bearing surface shall be at right angles to the axis of the threaded hole within a tolerance of 2 degrees for 5/8-inch nuts or smaller, and 1 degree for nuts larger than 5/8 inch; therefore, the maximum total run-out of bearing face would equal the tangent of specified angle times the distance across flats.

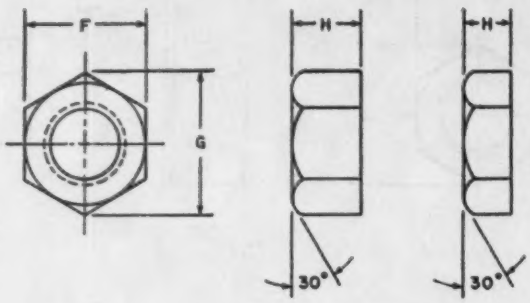
Thread shall be coarse- or fine-thread series, Class 2B.

Suitable material for steel nuts is covered by ASTM A-307; other materials will be as agreed upon by manufacturer and user.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

AMERICAN STANDARD REGULAR HEXAGON AND HEXAGON-JAM NUTS

1/4- to 5/8-inch sizes not recommended for new designs*



Nominal Size or Basic Major Diameter of Thread	Width Across Flats F			Width Across Corners G		Thickness Regular Nuts H			Thickness Regular Jam Nuts H		
	Max.	(Basic)	Min.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.
1/4 0.2500	7/16	0.4375	0.425	0.505	0.484	7/32	0.235	0.203	5/32	0.172	0.140
5/16 0.3125	9/16	0.5625	0.547	0.650	0.624	17/64	0.283	0.249	3/16	0.204	0.170
3/8 0.3750	5/8	0.6250	0.606	0.722	0.691	21/64	0.346	0.310	7/32	0.237	0.201
7/16 0.4375	3/4	0.7500	0.728	0.866	0.830	3/8	0.394	0.356	1/4	0.269	0.231
1/2 0.5000	13/16	0.8125	0.788	0.938	0.898	7/16	0.458	0.418	5/16	0.332	0.292
9/16 0.5625	7/8	0.8750	0.847	1.010	0.966	1/2	0.521	0.479	11/32	0.365	0.323
5/8 0.6250	1	1.0000	0.969	1.155	1.104	35/64	0.569	0.525	3/8	0.397	0.353
3/4 0.7500	1 1/8	1.1250	1.088	1.299	1.240	21/32	0.680	0.632	7/16	0.462	0.414
7/8 0.8750	1 5/16	1.3125	1.269	1.516	1.447	49/64	0.792	0.740	1/2	0.526	0.474
1 1.0000	1 1/2	1.5000	1.450	1.732	1.653	7/8	0.903	0.847	9/16	0.590	0.534
1 1/8 1.1250	1 11/16	1.6875	1.631	1.949	1.859	1	1.030	0.970	5/8	0.655	0.595
1 1/4 1.2500	1 7/8	1.8750	1.812	2.165	2.066	1 3/32	1.126	1.062	3/4	0.782	0.718
1 3/8 1.3750	2 1/16	2.0625	1.994	2.382	2.273	1 13/64	1.237	1.169	13/16	0.846	0.778
1 1/2 1.5000	2 1/4	2.2500	2.175	2.598	2.480	1 5/16	1.348	1.276	7/8	0.911	0.839

* The dimensions of 1/4- to 5/8-inch nuts are published for interim use during the change-over to the new standard until such time as complete conversion can be made.

All dimensions given in inches.

Nuts are not finished on any surface but are threaded.

Taper of the sides of nuts (angle between one side and the axis) shall not exceed 2 degrees, the specified width across flats being the largest dimension.

Tops of nuts shall be flat and chamfered or (except in jam nuts) washer-crowned. Diameter of the top circle shall be the maximum width across flats within a tolerance of minus 15 per cent.

Bearing surface shall be at right angles to the axis of the threaded hole within a tolerance of 3 degrees for 1-inch nuts or smaller, and 2 degrees for nuts larger than 1 inch; therefore, the maximum total run-out of bearing face would equal the tangent of specified angle times the distance across flats.

Thread shall be coarse-thread series, Class 2B tolerance.

Suitable material for steel nuts is covered by ASTM A-307; other materials will be as agreed upon by manufacturer and user.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

THE NEW STYLE NO. 48-B TOOL GRINDER is used for roughing and finishing large tools that do not require extreme accuracy. Also used for roughing or semi-finishing smaller tools.

THE NEW STYLE NO. 49-A TOOL GRINDER is a heavy-duty model. It is recommended for roughing and finishing large single-point tools or roughing smaller tools.

Simple operation allows quick training of inexperienced help—

There's a new Ex-Cell-O Tool Grinder to fit the needs of every shop, large or small. Designed for simple operation, you can quickly train even inexperienced help to become proficient at tool reconditioning.

Ex-Cell-O Tool Grinders accommodate a wide range of tool sizes and sharpen all grades of carbides, high speed steels, and cast alloys. They feature: sturdy construction, vibration-free operation, generously proportioned work tables, simple and exact angular adjustments, and table adjustment for wheel wear. All models are double end with reversible motors for left and right hand tools.

New Ex-Cell-O Tool Grinders

GIVE YOU THE FINEST CUTTING EDGES

THE NEW STYLE NO. 46-D TOOL GRINDER can be used for finish grinding and also for roughing small and medium tools.

THE NEW STYLE NO. 44-A TOOL GRINDER is a precision finishing grinder. An Ex-Cell-O Precision Spindle drives six-inch plate mounted wheels.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

XLO — EX-CELL-O for PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-14

WESTINGHOUSE ELECTRIC CORPORATION is expanding its transportation and generator division at East Pittsburgh, Pa., to meet increased demands from steel mill and electric utility customers. A four-story addition to its new research laboratories in Churchill Borough, Pa., is also being undertaken.

WALL MFG. CO., Grove City, Pa., announces the appointment of M. A. KAUFF as sales manager of its industrial division. The firm manufactures soldering products.

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., announces the appointments of WALTER SLINGER and BENJAMIN F. DOTY as welding engineers with headquarters at the company's New York branch, Harrison, N. J.

KENNAMETAL INC., announces the purchase of a 1200-acre tract of land near Latrobe, Pa., for the expansion of manufacturing facilities and to permit further decentralization to minimize flood damage.

FRED J. FLEISCHAUER has been appointed chief design engineer of the Special Machinery Division of the Teller Co., Butler, Pa.

Texas and California

REED ROLLER BIT CO., Houston, Tex., has appointed three new vice-presidents: C. H. ELLIOTT, former manager of the Cleco Air Tool Division, has been named vice-president of that division; at the Oil Tool Division, H. B. BOOK has been named vice-president—sales, and J. A. GRUNDY has been named vice-president—manufacturing.

WILLIAM S. HOWE has been named sales manager for domestic and foreign operations of the Koenig Iron Works, Inc., Houston, Tex.

F. D. ULLMANN CO., 2929-19th St., San Francisco, Calif., has been appointed representative of Loewy-Hydropress Division of Baldwin-Lima-Hamilton Corporation, New York City.

Canada

VON KAUFMAN has been appointed vice-president and general manager of Hayes Steel Products, Ltd., St. Catharine, Ont., Canada. He succeeds J. W. PRIMEAU. Mr. Kaufman joined Hayes in 1955 and was appointed vice-president in charge of operations last August.

Obituaries

PHILIP ARNOLD, retired vice-president of the Garlock Packing Co., Palmyra, N. Y., died on July 3 at the age of seventy-three years. Mr. Arnold served the company in a succession of sales capacities for forty-eight years, attaining in 1929 the position of vice-president in charge of sales. In 1950, he relinquished active direction of the company's sales activities, although remaining a vice-president in a partially active capacity. On July 1 his retirement was announced. He is survived by a son, Philip, Jr., and a daughter, Mrs. Boyd Gernhard.

ANCIL H. BISHOP, vice-president of U. S. Industries, Inc., New York City, died recently at the age of sixty-five years. Mr. Bishop had been in the Philippines for over forty years, where he was associated with Koppel (Philippines) Inc., a subsidiary of U. S. Industries, Inc. Mr. Bishop was elected vice-president of Koppel in 1931 and became its president in 1951. After returning to the United States, he was elected a vice-president of U. S. Industries, Inc., New York City. Mr. Bishop is survived by his wife, two sons, and a daughter.

FREAS M. LONG, retired director of foreign sales for the Gisholt Machine Co., Madison, Wis., died on July 26 at the age of seventy-two years. He had retired in 1955 after completing forty-eight years of service with the company and was a member of the board of directors at the time of his death.

New Books and Publications

BOOK OF ASTM STANDARDS

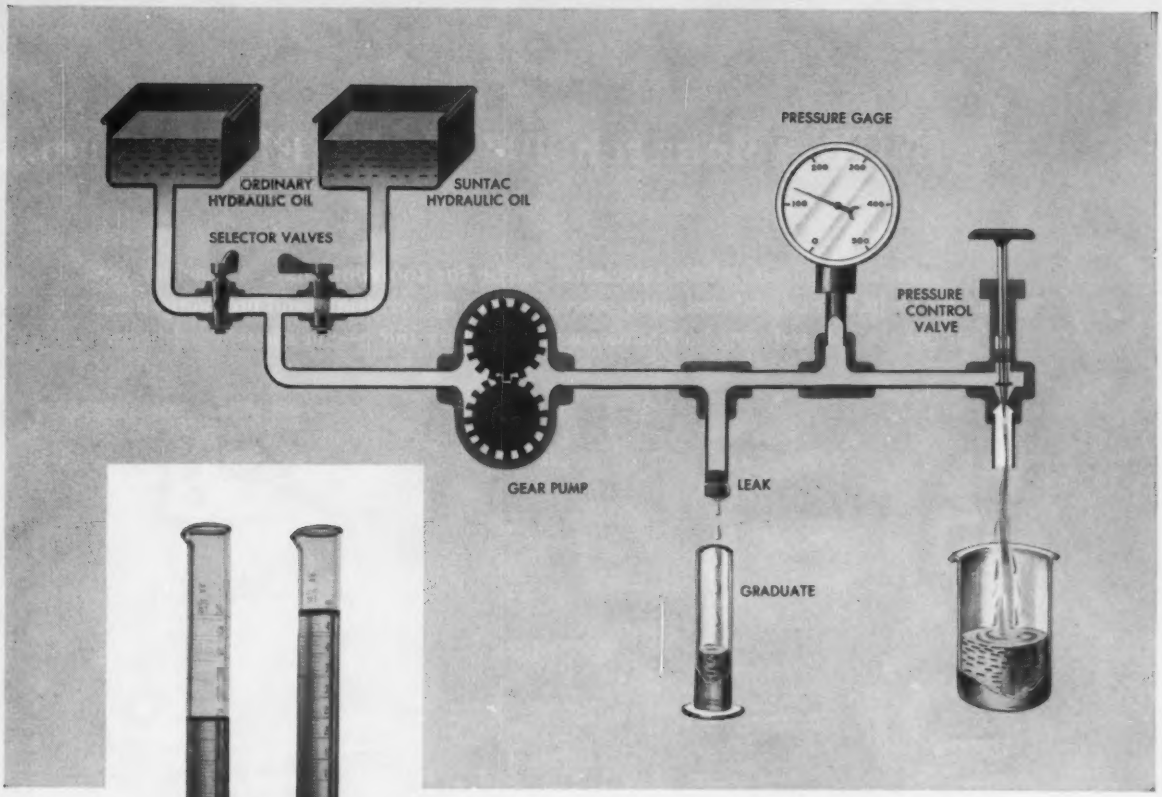
The 1955 edition of the American Society of Testing Materials' Book of Standards has over 11,000 pages and includes more than 2150 standard specifications, tests, and definitions for materials. This important technical book is an excellent example of the valuable results which come from the intensive work of the Society's many members and active technical committees. ASTM standards are used not only by American industry and on the North American continent, but by many industries and governments throughout the world. The book is issued in seven parts—each pertaining to a particular area or group of areas of materials—and is published on Bible type paper (to conserve shelf space and weight) with blue cloth covers and red backstrap.

Each part is complete with a detailed subject index and a list of standards in numeric sequence. The 1955 Book of ASTM Standards, containing 2153 standards as compared to the 1898 standards in the 1952 edition, is about 13 per cent larger than the 1952 edition. Since 1952, 1158 standards are new or revised.

To keep the book up to date, supplements will be issued to each part late in 1956 and late in 1957. As a service, a complete Index is furnished without charge with each set of the Book of ASTM Standards. The seven parts are made up and priced as follows:

	No. of Standards	No. of Pages	Price
Part 1—Ferrous Metals	315	1834	$13.50
Part 2—Non-Ferrous Metals	270	1516	11.00
Part 3—Cement, Concrete, Ceramics, Thermal Insulation, Road Materials, Waterproofing and Soils	477	2062	13.50
Part 4—Paint, Naval Stores, Wood Cellulose, Wax Polishes, Sandwich Building Constructions	323	1416	11.00
Part 5—Fuels, Petroleum, Aromatic Hydrocarbons, and Engine Antifreezes	242	1496	11.00
Part 6—Electrical Insulation, Electronic Materials, Plastics and Rubber	300	1776	13.00
Part 7—Textiles, Soap, Water, Paper, Adhesives, and Shipping Containers	354	1692	11.00
Complete Set—Seven Parts			$84.00

(*Continued on page* 258)



The leak rate of ordinary oil vs. Suntac was measured in test machine simulating a typical leak in a hydraulic system. Oil viscosities were equal, time and pressure conditions identical. The simple act of switching from the ordinary oil to Suntac, *without any other changes,* reduced oil leakage by 50%.

PRESSURE SYSTEM DESIGNED TO LEAK PROVES SUNTAC CUTS OIL LOSSES UP TO 50%

If you're having troubles with excessive oil leakage, a Suntac® oil can help you. Because of their unusual anti-leak characteristics, Suntac oils reduce oil consumption up to 90%, users report.

Suntac oils will not gum up or otherwise harm circulating systems. These oils are high-quality petroleum products with a life expectancy longer than that of ordinary hydraulic and circulating oils.

A change to a Suntac oil can lower your oil costs... improve housekeeping... result in safer working conditions.

Your Sun representative can tell you more about Suntac oils. Or write for Technical Bulletin 23. Address SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-9.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY Philadelphia 3, Pa.

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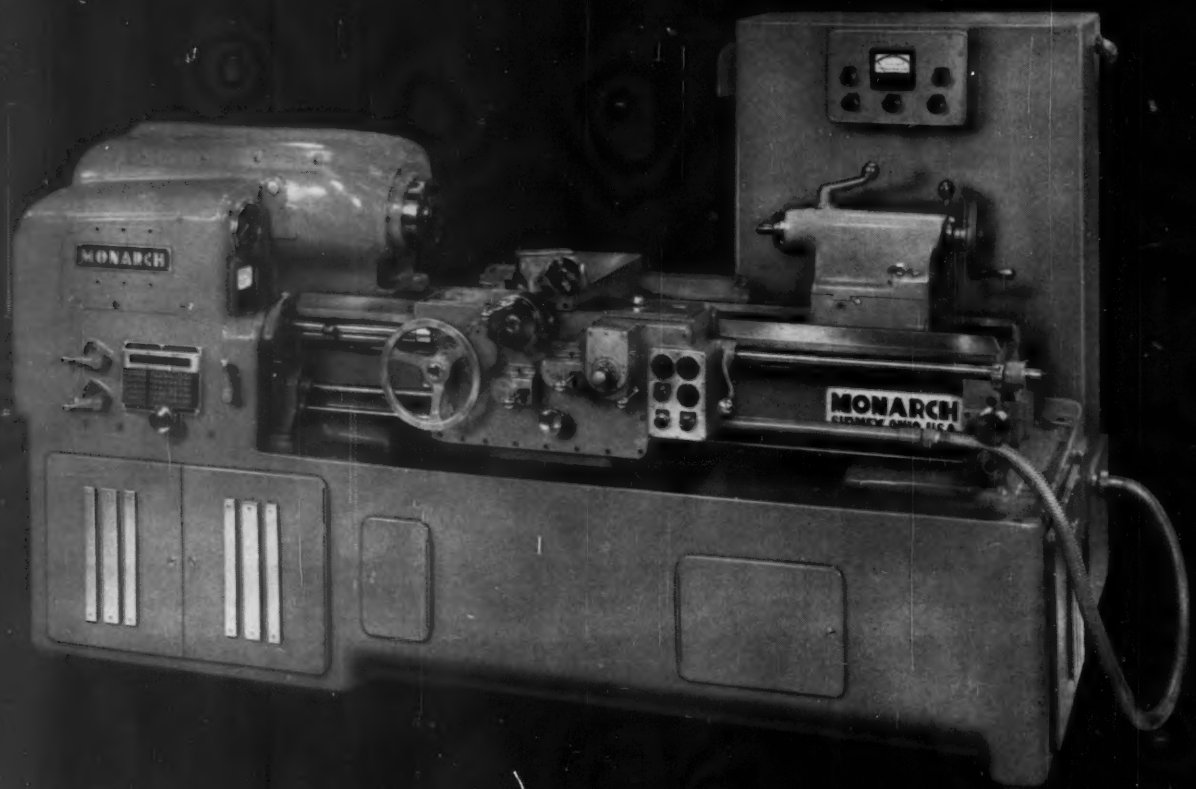
IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

For more information fill in page number on Inquiry Card, on page 231

NOW—Monarch 10″ Model EE Performance . .

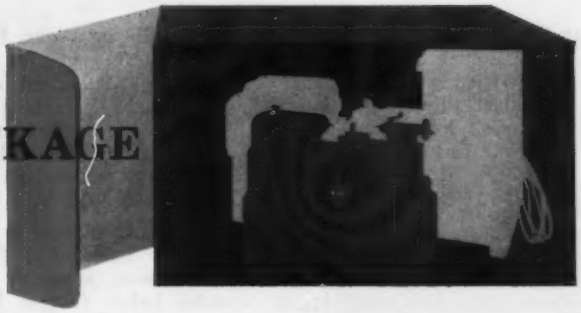
The Series EE, Model 1000 Precision Lathe for toolroom use. A machine for master toolmakers. Combines super-precision, extreme versatility and productiveness. Consider the cost reducing possibilities represented by the specifications listed below.



Swing over bed	15½″
Length between centers	30″ and 54″
Main drive motor	20 H. P.
Weight, 30″ machine	10,000 lbs.
Infinitely variable speeds up to	2,000 R. P. M.
Thread and feed changes	66

Electronic main drive motor control
Electric speed change
Four-way power rapid traverse
Built-in constant surface cutting speed

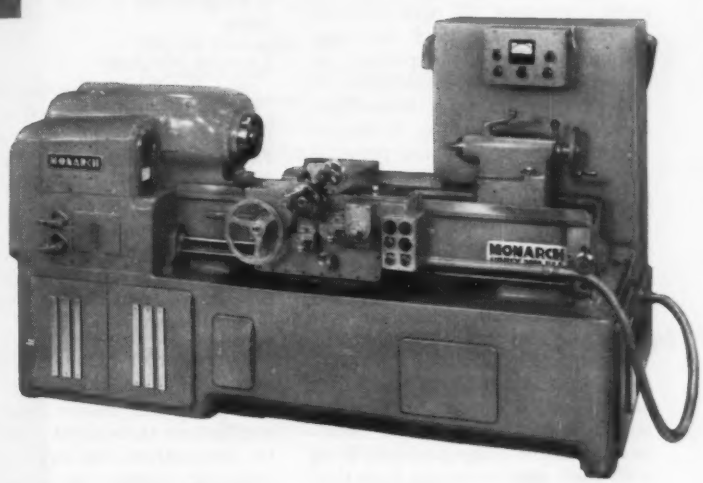
. . in a KING-SIZE PACKAGE



Are you faced with out-of-the-ordinary precision turning requirements? Have you longed for lathes having greater power, speed and versatility? If the answer is yes, here's great news.

The famous 10" Monarch Model EE Lathes now have two husky big brothers—the Series EE, Model 1000 Precision Lathe equipped either for toolroom or manufacturing use. They've got everything that's sold more than 6000 ten-inch Lathes to date—plus! Plus greater swing, more distance between centers, more power, more beef, more capacity and *inbuilt constant surface cutting speed.* Come see them in action!

It's EEze to reduce your turning costs with the Monarch family of EEs. Write for full information.
The Monarch Machine Tool Company, Sidney, Ohio.



The Series EE, Model 1000 Precision Lathe for manufacturing use. For precision production on all types of lathe operations except thread chasing. This machine is provided with a simplified six-feed gear box with either one of three feed ranges being available. It's stripped down, ready for action in *your* plant.

ASME HANDBOOK: ENGINEERING TABLES. Edited by Jesse Huckert. 704 pages, 7 by 10 inches. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $12.

Reference book sponsored by the Metals Engineering Handbook Board of the American Society of Mechanical Engineers—one of the four volumes comprising the ASME Handbook—containing many tables of recognized design standards of the type not commonly found in handbooks.

Typical of these is the table of involute functions—methods for finding loads on ball bearings and information on bars and tubes suitable for reworking into gears, levels, shafts, or screws.

The book is conveniently arranged in fifteen sections, grouping together tables that apply to the design of specific parts. It covers such subjects as bar stock and shafting; bearings; spur, helical and herringbone, bevel, and worm gears; cylindrical fits; keys and keyseating; bolts; springs, aircraft and mechanical tubing; serrations and splines; electrical motors, and gaskets.

Other volumes of the ASME Handbook are: Metals Properties, Metals Engineering—Design, and Metals Engineering—Processes.

COMPUTERS. By Edmund Callis Berkeley and Lawrence Wainwright. 366 pages, 6 by 9 inches. Published by Reinhold Publishing Corporation, 430 Park Ave., New York 22, N. Y. Price, $8.

This book describes and illustrates the latest developments in both the techniques and equipment of automatic computing. All basic elements of digital, analog, and miniature computers are fully explained, as are such important considerations as computer reliability, advantages, limits, and maintenance. A chapter is devoted to present and potential applications of computing machines in scientific laboratories, government military installations, and many business markets.

Mechanical, electrical, electronic, and chemical engineers will find this book packed with details on how these machines are constructed and will gain many ideas for future developments and applications. It will also prove of interest to business and industrial executives in determining where computers can fit in with their operations and how they can be obtained.

CENTRE LATHE WORK. By C. Monday. 160 pages, 5 1/2 by 8 1/4 inches. Published by the MACHINERY Publishing Co., Ltd., Brighton 1, England. Sold in the United States by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, $3.

This latest addition to British Machinery's Standard Reference Series reviews some of the latest centre lathes (engine lathes) and gives a general account of lathe practice. Seven chapter headings in the book are: The Centre Lathe— Its Construction and Types; Lathe Tools; External Cylindrical Work; Drilling, Boring, and Reaming in the Lathe; Taper and Elliptical Turning and Copy Turning; Screwcutting; and Miscellaneous Uses of the Centre Lathe.

BIBLIOGRAPHY HARDNESS & HARDNESS TESTING FROM 1937 TO 1955. 122 pages, 7 1/2 by 9 3/4 inches. Published by the Industrial Diamond Information Bureau, St. Andrew's House, 32-34 Holborn Viaduct, London, E.C. 1, England. Price 5s.6d.

This bibliography contains various sections including: books, brochures, and bibliographies (1822 to 1955); national standards; articles in technical and scientific journals (1937 to 1955); a name index (includes proprietary names); and a subject index which includes general items as well as materials tested items. A unique keyed lettering system is used to indicate the subject matter of the article or boow listed. This book is designed for all those working with hardness testing.

Reviews of Available Motion Pictures

CONTROL TRAINING COURSE

A slidefilm instruction course designed to aid in the training of industrial personnel in the selection and application of modern electric and electronic control equipment has been made available by the General Electric Co., Schenectady, N. Y. The course is composed of eight 35-millimeter color slidefilms and recordings which treat virtually every common aspect of control. It also includes an instructor's manual and eight review booklets which contain the script and illustrations from the films.

The slidefilms show how control equipment operates, what types of control are available, and how to select and apply the proper control for a specific application. The course is available on a single loan or sale basis.

VACUUM MELTING

A color film on vacuum melting of alloys is available for distribution from the Metals Division of Utica Drop Forge & Tool Corporation, Utica, N. Y. The seventeen-minute film traces the complete process of vacuum melting. Beginning at the conference table where the melt content is discussed, the route is then traced from test melt on to the finished ingot.

VERSATILITY OF HYDRAULIC PRESSES

A 16-millimeter sound-color film will bring the viewer into various installations throughout the country to demonstrate the application of hydraulic presses for stretch-forming, cold extrusion, flanging, forging, drawing, and forming. In the twenty-five-minute movie entitled "Pressure on Metalworking Production," close attention is paid to details of operation such as die set-up, stroke and pressure adjustment, and the handling of long- and short-stroke work. The sound-color film is available on free loan from the Lake Erie Engineering Corporation, Box 68, Kenmore Station, Buffalo 17, N. Y.

FORGING AND CASTING

"The Shape of Things," a 16-millimeter color and sound film on the Forging & Casting Plant of Allegheny Ludlum Steel Corporation, has been released for showing. It depicts the forging and casting of tools and end products made by Allegheny Ludlum's plant.

Items such as forging techniques, special anvil die work, the making of composite die sections, and general and special foundry practices are covered. Copies of the film are available for showing to organized groups on request to the Advertising Department, 2020 Oliver Building, Pittsburgh 22, Pa.

COMPOSITION AND USE OF COOLANTS

"Cutting Fluids," a twenty-minute, sound-color, motion picture has been released by the Texas Co. The film, intended for those concerned with metal machining operations, gives a basic summary of the role of coolants in metal-working practice.

A brief, basic discussion of how a cutting tool works is followed by an analysis of why the various compo-

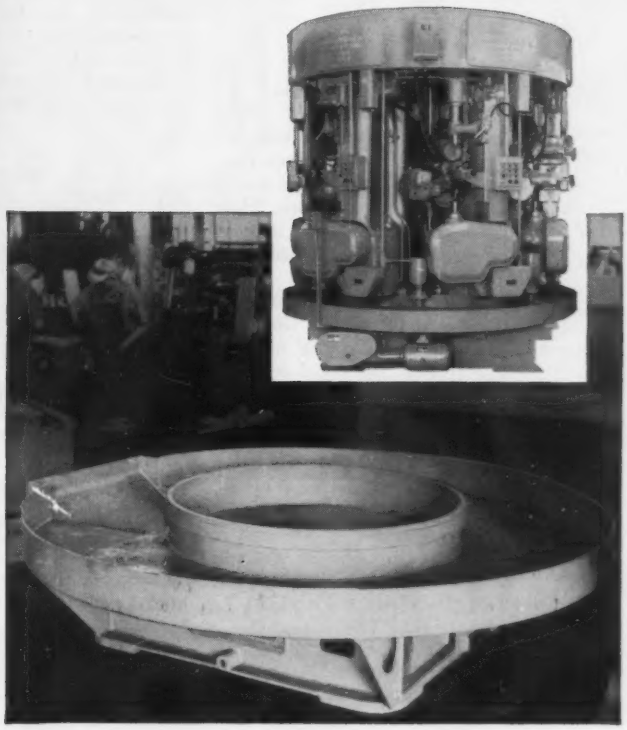
When a product design can be simplified...

Has greater strength... higher rigidity...

Yet takes less material... costs less to produce...

WHY use anything but welded steel

All welded base *for multiple spindle hobbing machine. Photos courtesy The Lees Bradner Company, Cleveland, O.*



Cost of manufacture cut 10%

by changing to welded construction

Formerly a casting, this machine tool base has changed over to welded steel construction, accomplishing several important benefits.

These benefits are:

1. **Lower cost** in fabricating and assembling.
2. **Simpler construction,** eliminating costly details like corner posts.
3. **Lower weight.**
4. **Closer alignment** of machine spindles.
5. **More rigid design,** incorporating integral coolant reservoir.

Benefits like these can be applied to many of your designs. Let Lincoln show you how. Write

THE LINCOLN ELECTRIC COMPANY

Dept. 1214 • Cleveland 17, Ohio

Creating Lower Costs for Industry . . .
With Welded Steel

For more information fill in page number on Inquiry Card, on page 231

nents and additives are used in a cutting oil. The remainder of the film describes water-based cutting fluids. Further information can be obtained by writing to the Texas Co., 135 E. 42nd St., New York 17, N. Y.

TRACER CONTROL

"Tracer Control in Action," a thirty-six-minute sound-color film (16-millimeter), showing difficult milling, profiling, and engraving operations being performed on Gorton tracer-controlled machines. The film, photographed under actual shop conditions, includes interesting operations such as simple two-dimensional engraving, production of the smallest engraving in the world, multiple-engraving of master copy type three-dimensional enlarging before reproducing at a fixed reduction, duplicating cam grooves on a cylindrical piece, profiling by automatic operation within the cutting cycle, and precision machining on a four-spindle indexing pantograph.

The film is available on a free loan basis on letterhead request to George Gorton Machine Co., 1321-T Racine St., Racine, Wis.

Coming Events

SEPTEMBER 17-21—Eleventh International Instrument-Automation Conference and Exhibit sponsored by INSTRUMENT SOCIETY OF AMERICA to be held at the New York City Coliseum. The society, which has its headquarters in Pittsburgh, Pa., has opened temporary offices at 250 W. 57th St. in New York City, from which it will direct the conference and exhibit.

SEPTEMBER 25-28—IRON AND STEEL EXPOSITION to be held in the Cleveland Public Auditorium, Cleveland, Ohio.

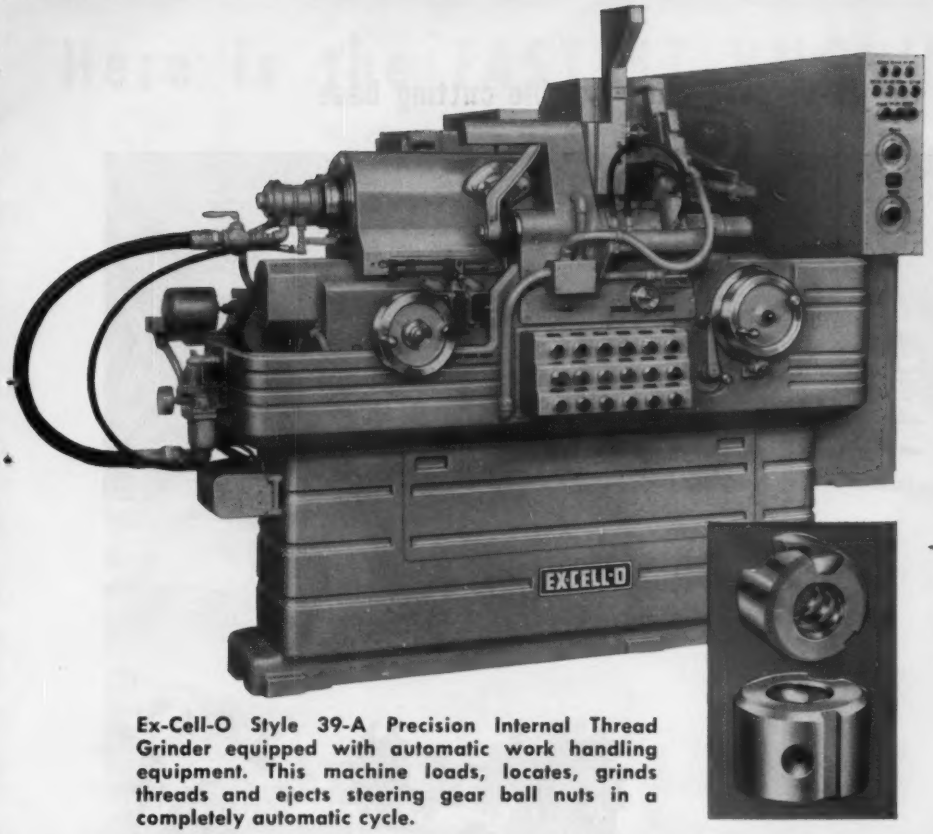
SEPTEMBER 27-29—Thirty-third annual meeting and national supervisory development conference of the NATIONAL MANAGEMENT ASSOCIATION to be held at the Sheraton-Jefferson Hotel in St. Louis, Mo.

OCTOBER 8-12—National Metal Congress and Exposition sponsored by the AMERICAN SOCIETY FOR METALS to be held at the Cleveland Public Auditorium and Exhibition Hall, Cleveland, Ohio. All equipment and new developments introduced by exhibitors will stress the "spend to save" theme. Further information can be obtained from W. H. Eisenman, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 22-26—NATIONAL INDUSTRIAL EXPOSITION to be held at Artillery Armory, 8 Mile Rd., Detroit, Mich. Top executives and organizations in industry and local governments are the sponsors in cooperation with the United States Departments of Commerce and Defense. Chairman of the Committee is Leeland M. Uhl. Exposition headquarters is at 927 Book Bldg., Detroit, Mich.

NOVEMBER 26-30—TWENTY-SECOND NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING under the auspices of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS to be held at the New York City Coliseum in conjunction with the Society's seventy-sixth annual meeting. As heretofore, it will be under the management of the International Exposition Co.

Students and teachers in a school for machine designers recently inaugurated by The Cross Company, Detroit, Mich. Eight young men are following a condensed course of drafting techniques for twenty-six weeks. Upon completion of preliminary instructions, the students will receive on-the-job training for three and one-half years. The trainees are high school graduates who underwent selection tests that indicate aptitude for becoming designers of automation machinery and special machine tools.



Ex-Cell-O Style 39-A Precision Internal Thread Grinder equipped with automatic work handling equipment. This machine loads, locates, grinds threads and ejects steering gear ball nuts in a completely automatic cycle.

EX-CELL-O
Thread Grinders
Manual – Automatic – Automated

EX-CELL-O STYLE 33 FOR EXTERNAL THREADS: An accurate production machine, automatic except for loading, unloading, and moving the cycle lever. Can be arranged for tapered grinding and for eccentric relief grinding.

EX-CELL-O STYLE 36 FOR LONG EXTERNAL THREADS, also available with internal attachment. A high production machine with easily adjusted work cycles.

EX-CELL-O STYLE 50: A versatile machine for external work . . . also available with internal attachment.

EX-CELL-O STYLE 120: Our largest Thread Grinder. Grinds 10 feet of thread in one setting. Accommodates 12 feet of stock between centers.

These standard machines are grinding thread gages, machine tool lead screws, innumerable aircraft parts, automotive steering mechanisms and pinions, worms, taps, and many similar workpieces.

Precision thread grinders in this Ex-Cell-O line range from manually-operated models, for toolroom and for short runs, to high production automatics, to styles equipped with automatic work handling equipment. There are five models designed to meet your every requirement.

For specific information on thread grinder operations or a quotation on a machine for your requirements, call your local Ex-Cell-O representative or write Ex-Cell-O in Detroit.

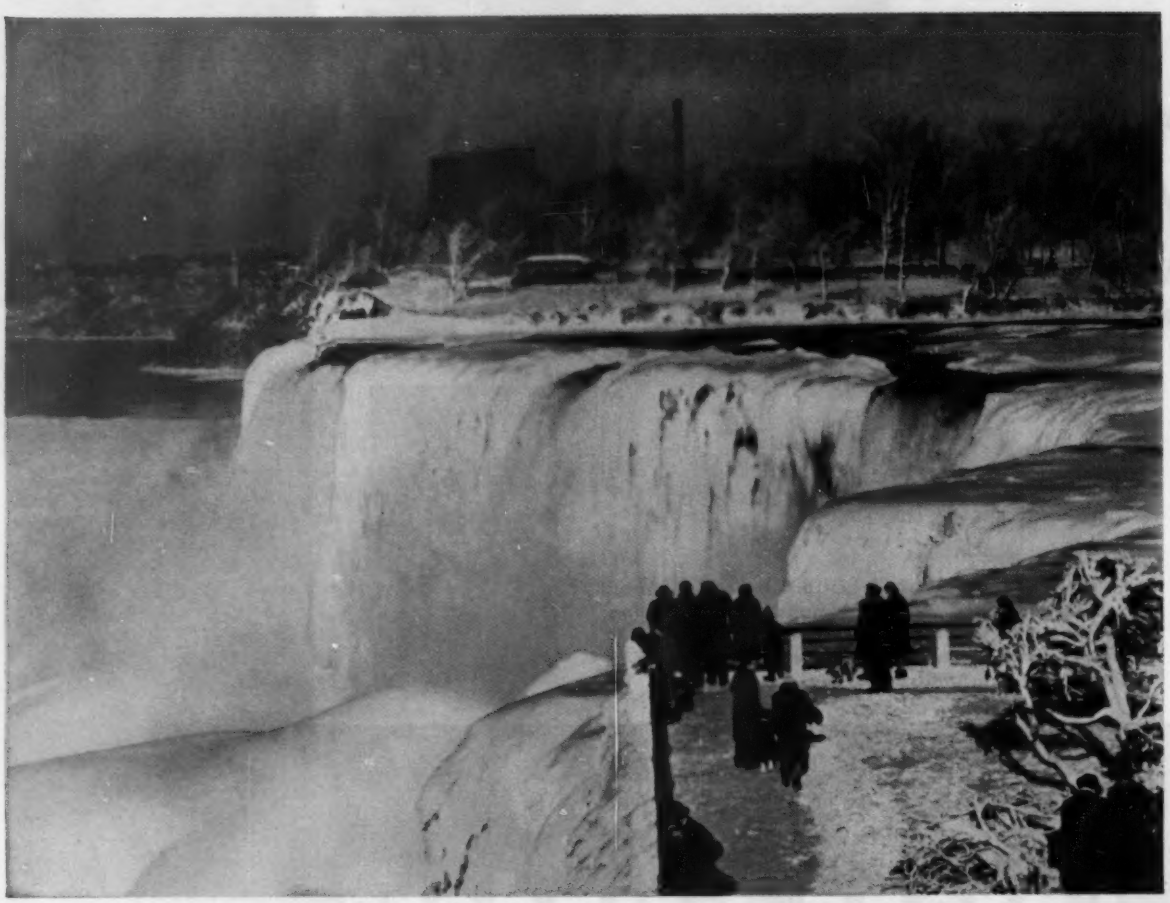
EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-5

ANTISEP the all-purpose water-soluble cutting base



Water is the fastest, cheapest coolant in the world

ANTISEP makes water work wonders for you!

In machining, water will carry heat away from tools and work much faster than any straight cutting oil. But water lacks other needed properties. That's where ANTISEP works its magic.

As little as 3% of this fortified all-purpose base added to water produces the finest cutting fluid money can buy. It combines high film strength with extra lubricity and anti-welding properties. Its antiseptic qualities protect workers and eliminate obnoxious odors from the shop. At an end cost of 8c per gallon in the machine, ANTISEP gives you longer tool life, higher quality work, and stepped-up production.

Ask to see the proof of ANTISEP's performance in metalworking plants—the Houghton Man has plenty to show you. A test can be arranged at your convenience. Just write to E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

ANTISEP all-purpose cutting base

...a product of

E. F. HOUGHTON & CO.

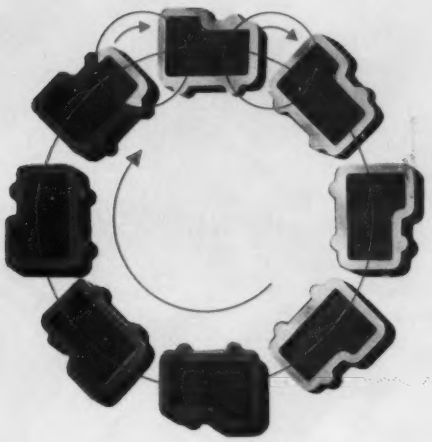
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service...

For more information fill in page number on Inquiry Card, on page 231

Here is the FASTEST KNOWN METHOD

of milling the flat surfaces of repetitive pieces

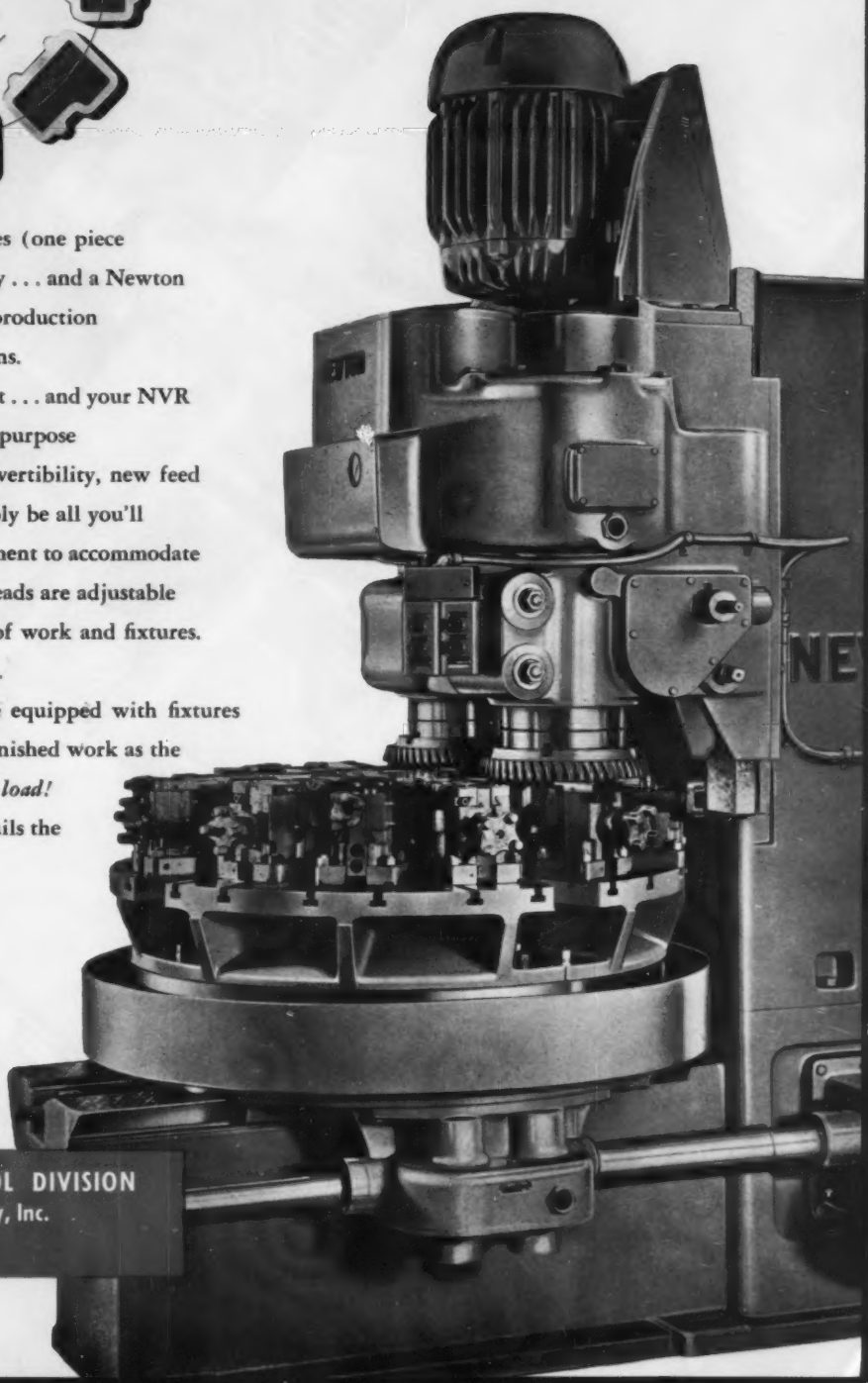


Mount your fixtures on base plates (one piece or sectional) for quick changeability . . . and a Newton Vertical Rotary will give you mass production economy on comparatively short runs.

Change the design of your product . . . and your NVR won't land in the morgue of single-purpose machine tools. Thanks to high convertibility, new feed and speed pick-off gears will probably be all you'll need. Tables have in-and-out adjustment to accommodate cut-circles of different diameters. Heads are adjustable up and down for different heights of work and fixtures. Spindles are individually adjustable.

Newton Vertical Rotaries can be equipped with fixtures that clamp, unclamp and eject the finished work as the table turns. *All the operator does is load!*

Write for bulletin 651, which details the advantages of these machines.

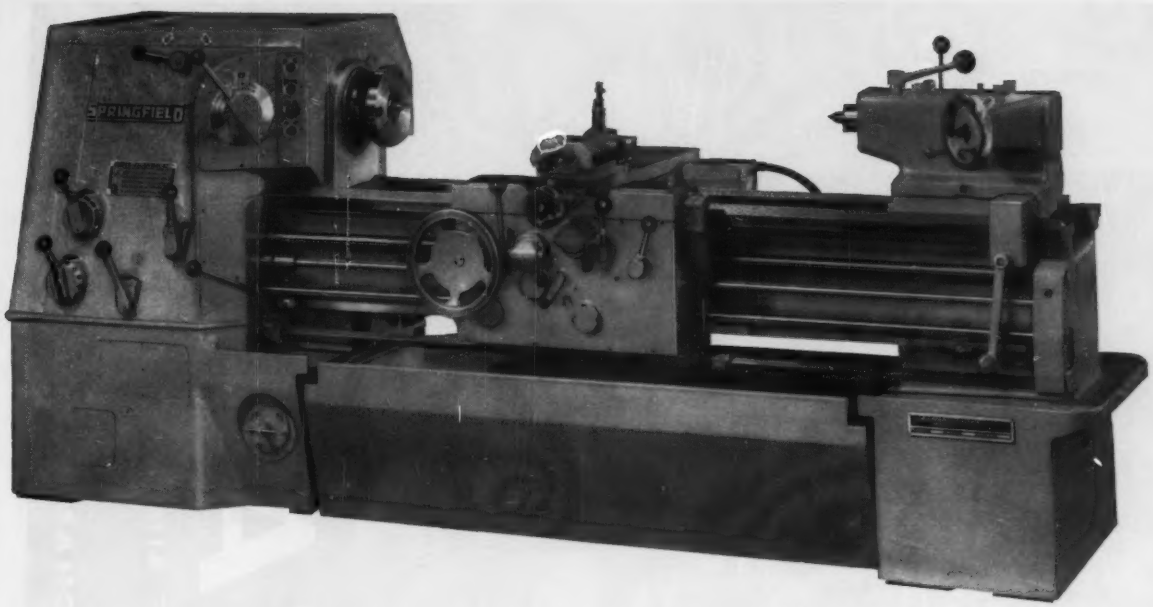


F/B

CONSOLIDATED MACHINE TOOL DIVISION
Farrel-Birmingham Company, Inc.
ROCHESTER 10, N. Y.

CM-4

SPRINGFIELD



more useful horsepower

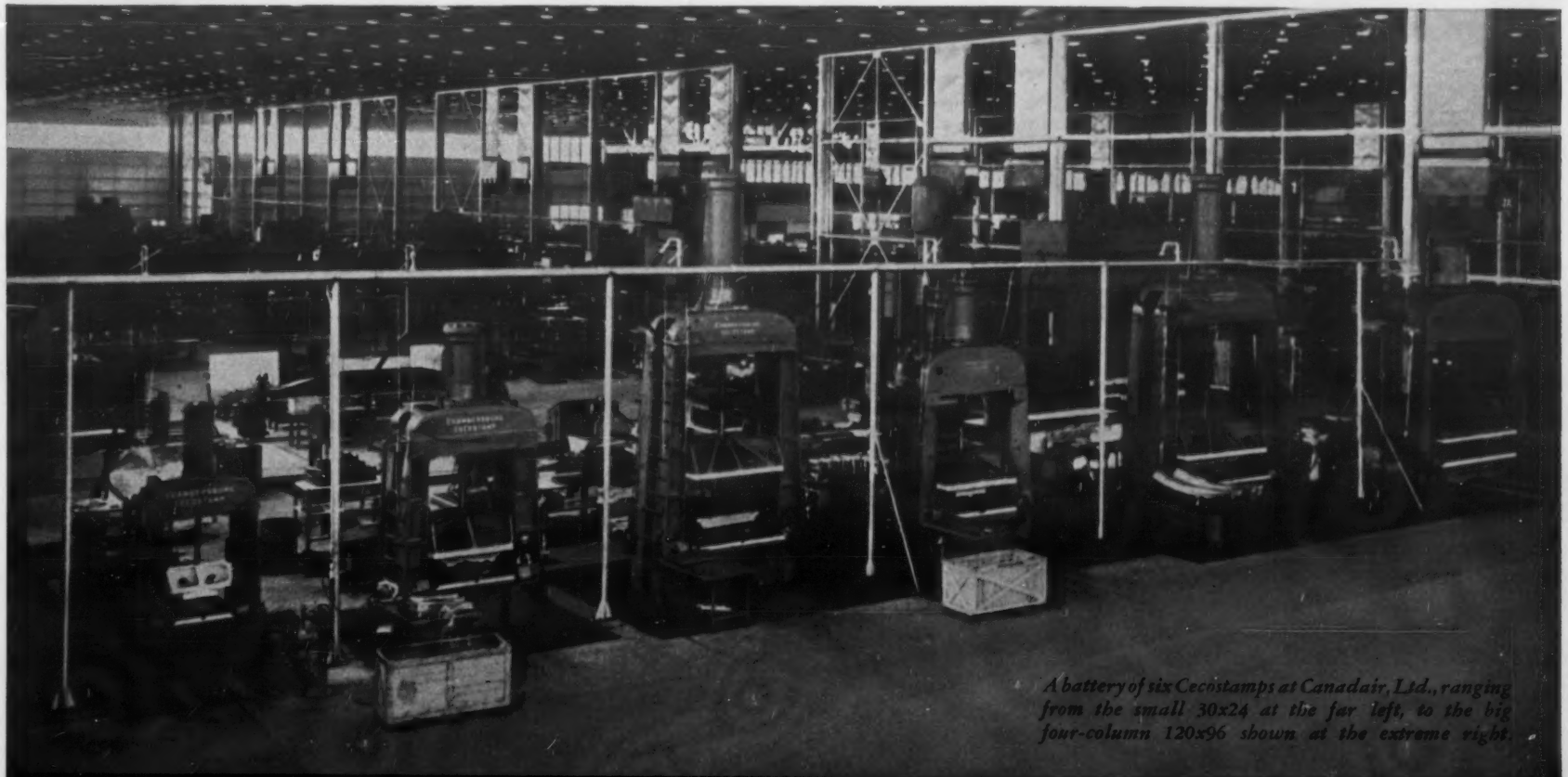
All the horsepower in a Springfield Model "S" Lathe is productive.
A simple, straight-forward gear train, plus double-action lubrication, plus tight dynamic balance tolerances (.0005" displacement) eliminate friction and vibration, the twin horsepower thieves.
In the headstock, only the gears necessary to a given speed are engaged. Other gears run free with a stabilizing flywheel action, no drag on power.
A high pressure filtered oil mist keeps all gears and bearings drenched, and a cascade of oil lubricates the feed box.

Lathes: Engine and tool room, contouring and reproducing—swings 14" to 32".
Vertical Universal Grinders: swings 18" to 42".

The Springfield Machine Tool Company
Springfield, Ohio

65TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

SPRINGFIELD



A battery of six Cecostamps at Canadair, Ltd., ranging from the small 30x24 at the far left, to the big four-column 120x96 shown at the extreme right.

CECOSTAMP

THE STANDARD IMPACT DROP STAMP OF THE AIRCRAFT INDUSTRY

Write for a copy of Bulletin 30-L-5

CHAMBERSBURG ENGINEERING COMPANY · CHAMBERSBURG, PENNA.

AT LAST! LOW COST COOLANT CLARIFICATION... NEW DE LAVAL COOLANT CLARIFIER...

Designed for *individual* use on grinding, honing or turning units, the new De Laval Model 115 Coolant Clarifier lengthens coolant life . . . eliminates costly filter replacements...reduces down-time for tool replacement and dressings . . . removes all types of contaminants.

This new De Laval Coolant Clarifier takes up minimum floor space (2 feet diameter by less than 2 feet height) . . . handles all types of coolants—both oil and aqueous. A skimming device is available for volatile liquids.

Get all the details on De Laval's new Coolant Clarifier . . . today.

DE LAVAL
SEPARATOR COMPANY

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 201 E. Millbrae Ave., Millbrae, Calif.

IT'S QUIET ON THE MEZZANINE ...WHILE THE MEN BELOW

rivet

...NOT 15 FEET AWAY!

This is a riveting line at the Irving Subway Grating Co., Long Island City, New York. *Yet you cannot hear the riveting!* Why? Because it's done with Hannifin "Hy-Power," the modern cold-squeeze riveting method.

Compact "Hy-Power" Portable Yoke Riveters quietly exert the force. The power is supplied by "Hy-Power" Hydraulic Pressure Generators (you see them right up there beside the man who is consulting the files) . . . compact, single units that include motor, pump, oil reservoir, control valves and high pressure intensifier.

HOW TO REDUCE YOUR RIVETING COSTS

Do it the "silent squeeze" way with Hannifin portable and stationary yoke riveters which are available in capacities from 7½ to 100 tons (more in multiple). It's a fast method. It's a method that assures complete uniformity of every rivet. It's a safe method; for while a touch of a button starts the ram, the stroke may be interrupted and the ram reversed at any point in the cycle, simply by releasing the control button.

See your Hannifin representative who will demonstrate why "Hy-Power" riveting and punching equipment has a place in your production picture. Hannifin Corporation, 509 S. Wolf Road, Des Plaines, Illinois.

WRITE FOR BULLETIN 150

The complete story of Hannifin "Hy-Power" Hydraulics. Your copy sent on request.

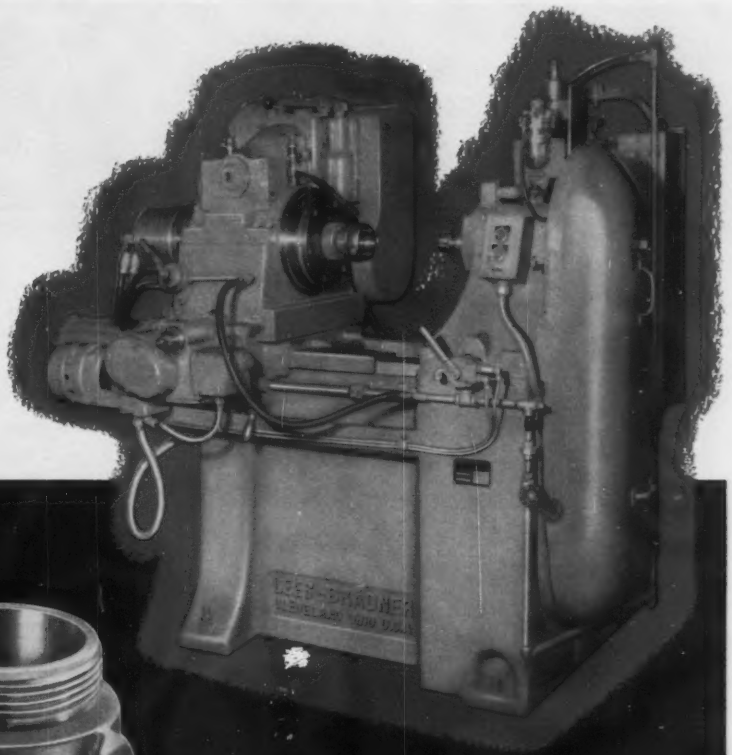
do ALL you can do . . . with

HANNIFIN

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

Hannifin Corporation, 509 S. Wolf Rd., Des Plaines, Ill.

It took this HIGH-SPEED Heavy-weight to lick this tough job!



The Lees-Bradner Special High Speed Thread Milling Machine

The Lees-Bradner Special Thread Milling Machine really shows its class when it works with brass!

The Akron Brass Manufacturing Company of Wooster, Ohio produces these threads, internal and external, each in 13 seconds with a 5000 RPM cutter spindle speed.

This is just one example of the many threading jobs that the modern, high speed, Special Thread Milling Machine can do better, faster and with unmatched precision.

Write The Lees-Bradner Company for full information on this remarkably versatile machine.

DETAILS ON THIS JOB

Hob Spindle Speed, 5000 R.P.M.
(Using a high speed cutter spindle)

Thread Pitch
(internal and external) . . . 7½

Thread Diameter . . . . . 3″

Length of Thread . . . . . ¾″

Threading Time . . . . 13 seconds

Material . . . . . Brass

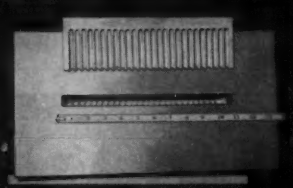
Weight of Parts
Internal thread . . 1 lb. 13 oz.
External thread . . 2 lb. 10 oz.

the LEES-BRADNER Company

CLEVELAND 11, OHIO • U.S.A.

WE SAVED
19 MINUTES

WE SAVED
16 HOURS



WE SAVED
379 HOURS

WHATEVER YOUR COSTS ARE
NOW . . . CONTACT ELOX

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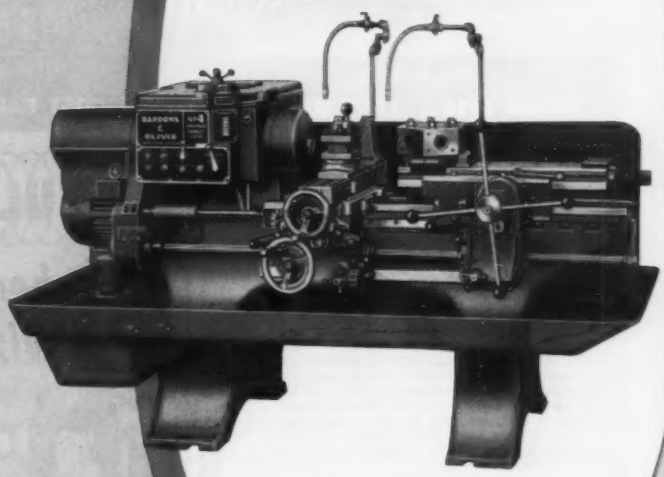
HARDENED & GROUND

Alloy Steel Bed Ways . . . can mean the difference between normal turret lathe life and very rapid deterioration.



• To insure the long life accuracy of Bardons & Oliver Turret Lathes, bed ways are of hardened and ground alloy steel and are replaceable. Final superfinishing provides frictionless carriage travel. Closely spaced alloy steel studs hold the bed ways rigidly to the bed. The front bed way extends beneath the headstock to provide longer bearing for, and increased rigidity of, the cross slide carriage.

The integrally cast headstock and bed assures permanent alignment of spindle and bed ways. Diagonal "V" ribbing between the bed walls extends for the entire length of bed and beneath the headstock.

The superior design combination of headstock, bed and bed ways is only one of the features we are proud to offer. For complete information on the advantages of Bardons & Oliver Turret Lathes, write us on your company letterhead.

Manufacturers of a complete line of Turret Lathes and Cutting-Off Lathes.

BARDONS & OLIVER, INC.

1135 WEST 9TH STREET • CLEVELAND 13, OHIO

Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt

Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES

See Discs, abrasive

ABRASIVES, HONING

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.

Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

Why pay for bulk you don't need...
FULMER MACHINES MEET EVERY HONING DEMAND
WEIGH LESS...TAKE UP LESS ROOM...COST FAR LESS!
A tremendous hulk of cast iron may look impressive...but it adds nothing to honing...except cost! Fulmer Honing Machines are scientifically engineered to provide maximum output and accuracy at lowest cost. "Beef" is put where it's needed most, for example: in the rugged power transmission system...and "streamline" where design dictates—in the columns, for example.
This is only one of many reasons why Fulmer Honing Machines may be as little as one-half the cost of other makes—yet equal or exceed them in rate of stock removal, accuracy of parts honed, ease of operation and quick set-up. Oversize parts, such as gears and bearings, stand up under three shifts a day operation . . . 7 days a week . . . for years, with little or no service needed.
Fulmer precision honing of internal bores offers amazing savings over other finishing methods. Write for bulletin on honing to: C. Allen Fulmer Co., Dept. M 107 E. 4th St., Cincinnati 2, Ohio.
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equipment

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Bethlehem Steel Co., Bethlehem, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Vickers Incorporated Division of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

AIR HOISTS—See Hoists, Air

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Magnesium

Dow Chemical Co., Midland, Mich.

ALLOYS, Non-Ferrous

American Brass Co., 25 Broadway, New York.
Bridgeport Brass Co., Bridgeport, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ALLOYS, Zinc

New Jersey Zinc Co., 160 Front St., New York, N. Y.

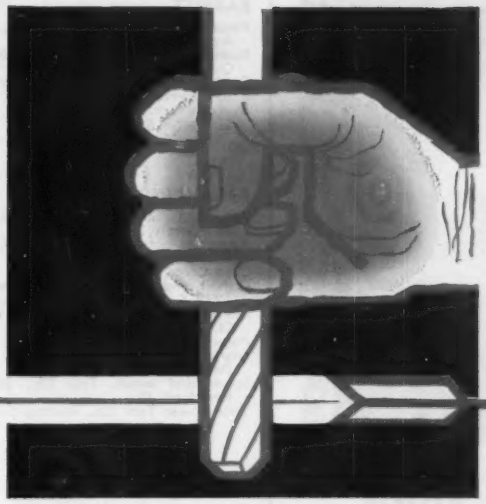
See Presses, Arbor

ARBOR PRESSES

ARBORS AND MANDRELS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., Milwaukee, Wis.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Shenango-Penn Mold Co., Dover, Ohio.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page* 274)

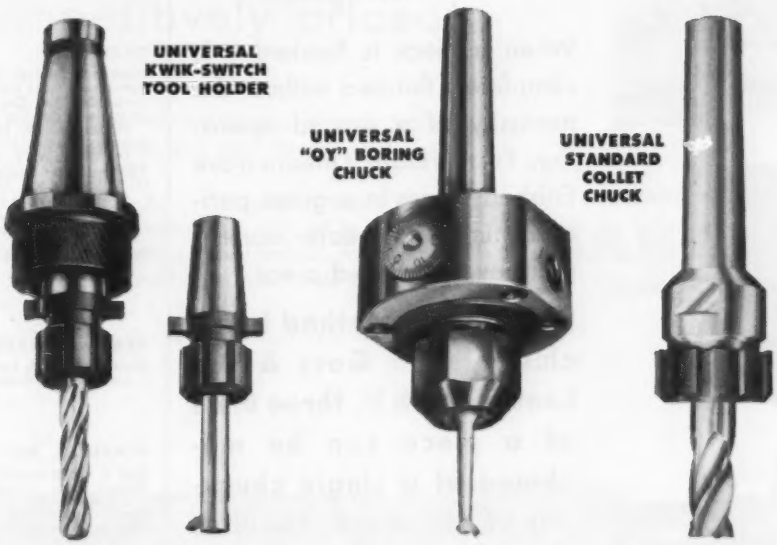


positive
grip

and true-running

tools

ARE CERTAIN WITH UNIVERSAL CHUCKS SUCH AS THESE:



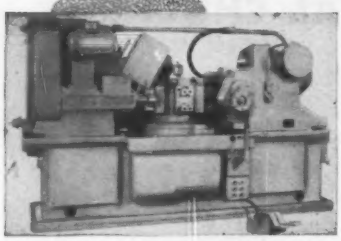
A sure, solid grip on tools is provided by the wrap-around action of Universal chucks because the slotted collet grips the tool on a continuous surface the full length of the collet. This positive grip, plus the precision manufacturing of all Universal chucks, keeps tools running true to .001" within an inch from the nose of the chuck. Our simplified chuck design eliminates auxiliary bearings, resulting in low cost to you. Sizes range from 1/16" to 1 1/2", with shanks to fit any machine. For complete information on these three or other Universal chucks, write the office nearest you: Universal Engineering Sales Co., 1060 Broad St., Newark, N. J., 5053 Sixth Ave., Kenosha, Wis., or our home office in Frankenmuth.

UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 2, MICHIGAN

195

GOSS and DE LEEUW
AUTOMATIC CHUCKING MACHINE



means a complete piece... at each index cycle

When a piece is finished it is *completely* finished without the necessity of a second operation. Furthermore it means *more* finished pieces in a given period of time and greater accuracy in *every* finished piece.

The "1-2-3" Method is exclusive with Goss & DeLeeuw. With it, three ends of a piece can be machined at a single chucking of the work, simultaneously or in sequence depending on the operations involved. It will pay you to investigate.

Send for illustrated literature giving detailed information. Send samples and ask us to give you cost estimates of handling this work on a "1-2-3" Goss & DeLeeuw Automatic Chucking Machine

GOSS & DELEEUW
QUALITY PRODUCT-QUANTITY

GOSS & DE LEEUW
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American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Ryerson, Jas. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Illinois

BALLS
Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Shenango-Penn Mold Co., Dover, Ohio

BARS, Steel
Allegheny Ludlum Steel Corp., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

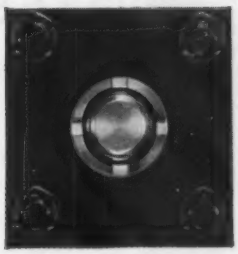
BEARINGS, BABBITT
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

BEARINGS, Ball
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., Poughkeepsie, New York.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Shenango-Penn Mold Co., Dover, Ohio.

BEARINGS, Lineshaft
Fafnir Bearing Co., New Britain, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

(*Continued on page* 278)



Here are the world's finest power cylinders

...competitively priced!

This ad is written for the man who has thought all cylinders are "pretty much alike." That just isn't so, and your Hannifin man would like an opportunity to show you why...

He'll show you design features that other cylinders simply do not have... extra quality workmanship at critical points that pays off in longer life ...accessibility that simplifies their infrequent maintenance. And when he talks price and delivery, you will find these better features cost you no more, can often be delivered sooner.

We think you'll agree that it pays to standardize on Hannifin cylinders.

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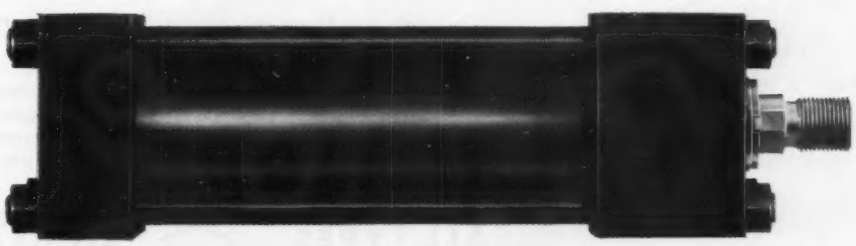
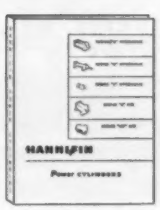
HANNIFIN

POWER CYLINDERS



COMPLETE CYLINDER FILE

Write for your copy of this new Hannifin Cylinder File . . . complete, easy-to-use, easy-to-order-from information on five lines of Hannifin Cylinders. Write Hannifin Corporation, 509 S. Wolf Road, Des Plaines, Ill.



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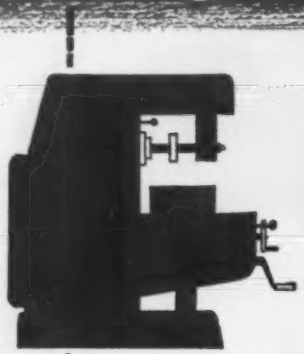
production begins with



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Contact Columbus Die-Tool & Machine Co. first—when you have a special machine problem. They are nationally known as expert designers and builders of special machinery and equipment . . . have been for over 50 years.

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JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

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by BILGRAM!

Your special gear requirements get special attention at BILGRAM. Worms and Worm Gears, for example, are produced for you on the latest equipment, in a fully modern plant, by specialists with over 70 years' experience in solving gear problems.

And the same is true of all types of gears —Bevels of all kinds . . . Ellipticals . . . Herringbones . . . Helicals . . . Racks . . . Spurs . . . Hypoids . . . as well as Worms and Worm Gears. Whatever your gear problems, put them in our lap! We'll meet your most exacting requirements for performance.

ALL TYPES BILGRAM OF GEARS

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NORMA-HOFFMANN Sealed Bearings

Give You Dependable Trouble-Free Performance

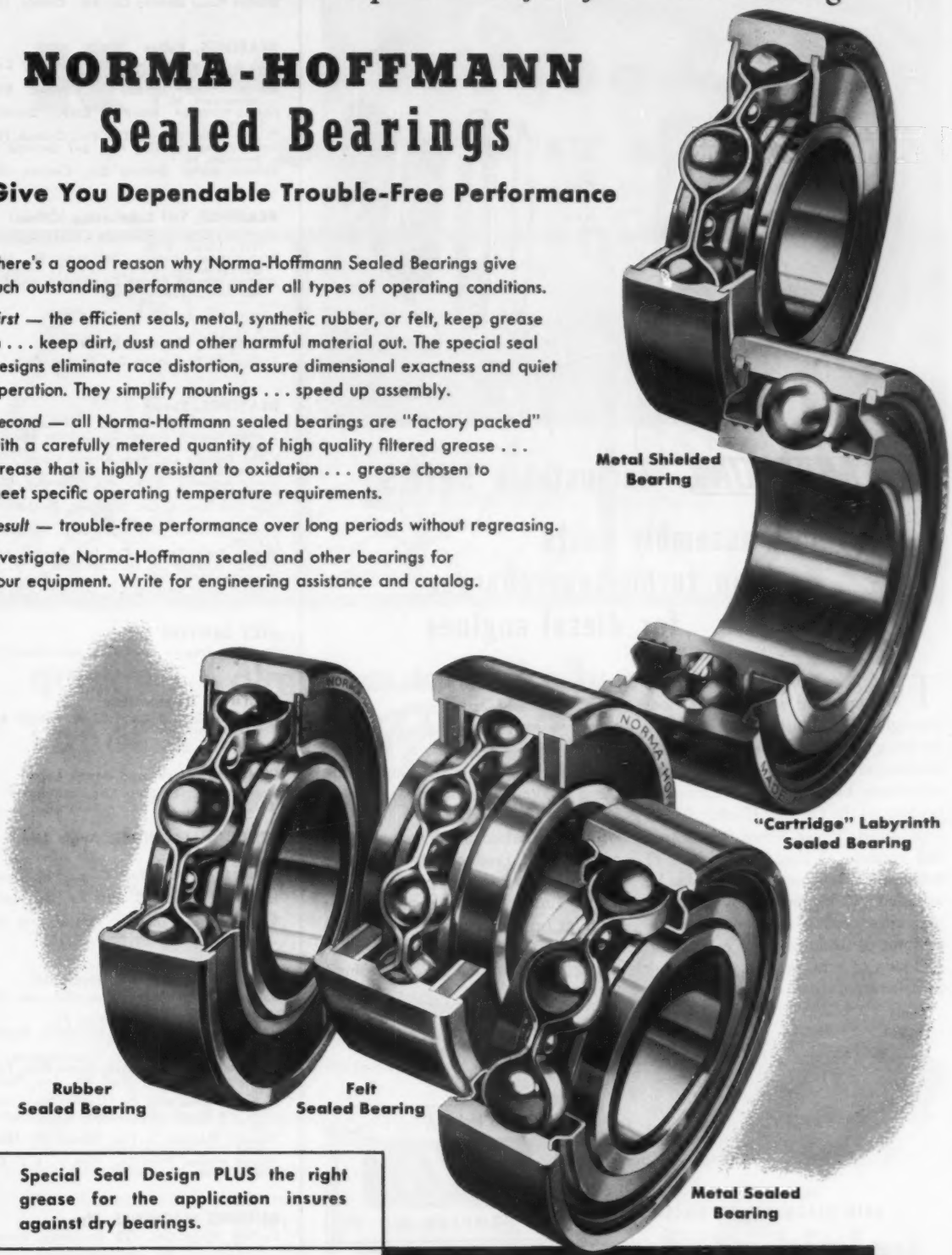
There's a good reason why Norma-Hoffmann Sealed Bearings give such outstanding performance under all types of operating conditions.

First — the efficient seals, metal, synthetic rubber, or felt, keep grease in . . . keep dirt, dust and other harmful material out. The special seal designs eliminate race distortion, assure dimensional exactness and quiet operation. They simplify mountings . . . speed up assembly.

Second — all Norma-Hoffmann sealed bearings are "factory packed" with a carefully metered quantity of high quality filtered grease . . . grease that is highly resistant to oxidation . . . grease chosen to meet specific operating temperature requirements.

Result — trouble-free performance over long periods without regreasing.

Investigate Norma-Hoffmann sealed and other bearings for your equipment. Write for engineering assistance and catalog.



Special Seal Design PLUS the right grease for the application insures against dry bearings.

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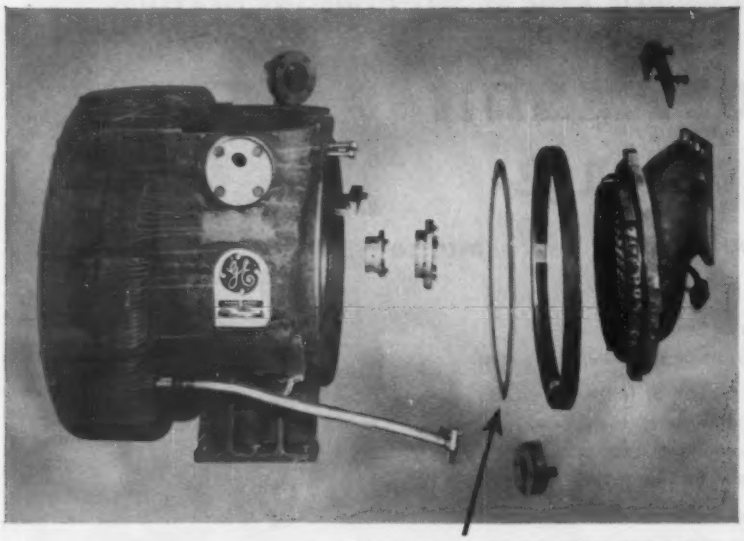

LAMINUM® adjustable SHIMS

cut assembly costs on turbo-supercharger for diesel engines

THIS is only one from thousands of laminated shim applications throughout all industry. Yet the reason for using laminated shims and the gains resulting are typical. This shim sets the clearance between the nozzle and buckets on the General Electric RD3C turbo-supercharger. Shimming is essential because of the accumulation of tolerances. The laminated shim can be adjusted quickly merely by peeling—and after peeling is always precisely uniform in thickness from end to end and side to side. Peeling is far easier and faster than precision grinding which would prove quite costly on these extremely large shims.

Whenever you need shims, call the Laminated Shim Company *first*...for fast, complete service. We manufacture shims in aluminum, brass, steel—small as a fingernail and large enough for locomotives...laminated, spot-soldered or looseleaf. Produced to your own precise blueprint specifications.

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SHIM HEADQUARTERS SINCE 1913

LAMINATED SHIM COMPANY, INC.

The name Laminum is registered with U. S. Patent Office

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LAMINATED SHIMS OF LAMINUM® AVAILABLE IN BRASS • STEEL • STAINLESS STEEL • ALUMINUM

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BEARINGS, Roller
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Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Self Lubricating (Oilless)
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

BEARINGS, Tapered Roller
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Shenango-Penn Mold Co., Dover, Ohio.
Timken Roller Bearing Co., Canton, Ohio.

BELT SHIFTERS
Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, Transmission
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BENCHES, Work, and Bench Legs
Standard Pressed Steel Co., Jenkintown, Pa.

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Consolidated Mch. Tool Corp., 656 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

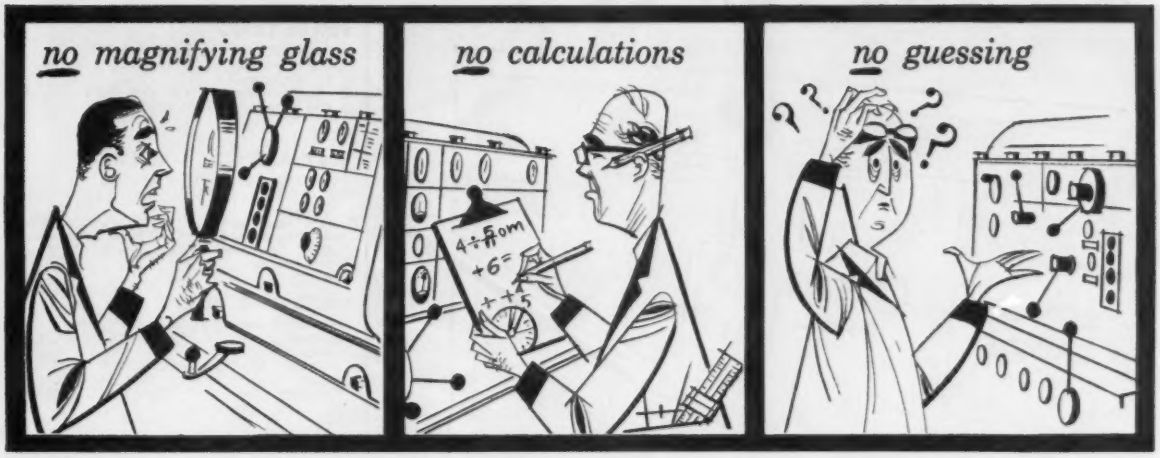
BENDING MACHINES, Hydraulic
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Farquhar, A. B., Div. Oliver Corp., York, Pa.

BLAST CLEANING EQUIPMENT
Modern Ind., Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagerstown, Md.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

(*Continued on page* 280)

Know your feed... set your speed!

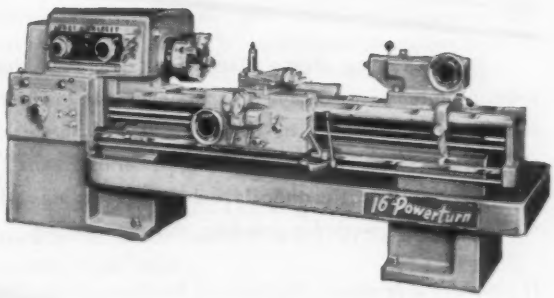


quickly . . . almost automatically with the LODGE & SHIPLEY *Powerturn* LATHE and SPEED-DIAL HEAD!

Take "by-guess" and "by-golly" confusion out of lathe operation! Lodge & Shipley POWERTURN Lathes with *Speed-Dial* Head make speed selection and setting simple as **a...b...c!**

a . . . set work diameter
b . . . read r.p.m. opposite cutting speed
c . . . set levers to automatic indicator lights

This time-saving, fool-proof simplicity is but one feature of New POWERTURN Lathes. Combined with traditional Lodge & Shipley accuracy and rugged strength are many other features for new precision and new operating convenience. New literature . . . ready now . . . tells the complete story: how POWERTURN Lathes are designed to facilitate turning to higher levels of profitable operation. 13, 16 and 20-inch sizes; Engine, Toolmaker and Gap types plus famous COPYMATIC with both 45° and 90° tool slides. **The Lodge & Shipley Company, 3055 Colerain Ave., Cincinnati 25, Ohio.**



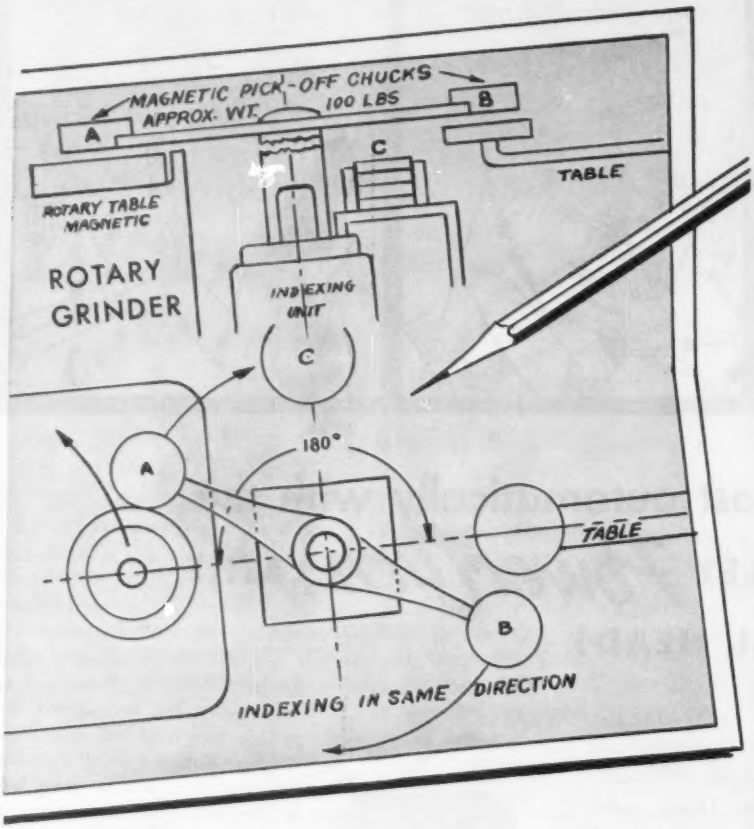
Lodge & Shipley

your LODGE-*ical choice!*

For more information fill in page number on Inquiry Card, on page 231

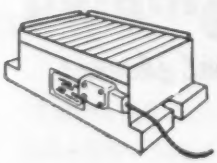
There may be a clue for you in this unusual application idea for

MAGNA-LOCK MAGNETIC CHUCKS...



Drawing shows Magna-Lock magnetic chucks incorporated in indexing mechanism designed to automatically load and unload parts from rotary surface grinder. The Magna-Lock chucks hold the work pieces during the indexing cycle. The extra holding power of Magna-Lock electro-magnetic chucks has solved many difficult problems of feeding and transferring parts as well as holding work for grinding, milling, turning.

If you have a problem, Magna-Lock has the engineering skill and experience to help you solve it. Write today, Dept. M-96.



Hanchett MAGNA-LOCK CORPORATION

BIG RAPIDS, MICHIGAN, U.S.A.

designers and makers of a complete line of magnetic chucks and devices.

BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BLUING LAYOUT
Dykem Co., 2303P. N. 11th St., St. Louis 6, Mo.

BLUEPRINT MACHINERY & ACCESSORIES
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

BOILER TUBES
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOOKS, Technical
Industrial Press, 93 Worth St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES
Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Strippet Co., North Tonawanda, New York

BORING AND TURNING MILLS, Vertical
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

(Continued on page 282)

175 Machine Operations on 128 Cylinder Heads

= 22,400 OPERATIONS PER HOUR

Functioning automatically in TIMED SEQUENCE, this BAUSH TRANSFER LINE is producing accurately machined parts at low cost for a leading automotive manufacturer's new V-8 engine.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

This 21 Station Baush Transfer Line consists of:

1 Loading; 13 Working; 2 Roll-over; and 5 Idle Stations having
12 Vertical Angular Model "S" Mechanical Leadscrew Units —
4 Horizontal Model "S" Mechanical Leadscrew Units —
1 Vertical Model "S" Mechanical Leadscrew Unit —
4 Horizontal 30F-18 Hydraulic Units —
1 Vertical Hydraulic Unit mounted on hydraulic horizontal slide —
2 Vertical Angle Hydraulic Checking Units —
22 Fixed Center Heads having a total of 175 spindles —
6 Transfer Power Units —
2 Roll-over Fixtures —
6 3-position Transfer Sections with Arch Fixture and Bushing Plates.

OPERATIONS:

Mill — Drill — Ream — Chamfer — Counterbore and Countersink — Spotface and Tap.

PRODUCTION:

Approximately 128 Cylinder Heads per hour at 100% efficiency.

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Indiana

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Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mach. Co., 2442 Douglas St., Rockford, Ill.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING, DRILLING AND MILLING MACHINES, Horizontal

(Floor, Planer or Table Types)

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R. Evanston, Cincinnati, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Innocenti Corp., 43 W. 61st St., New York 23, N. Y.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bryant Chucking Grinder Co., Springfield, Vt.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Wadell Equipment Co., 119 So. Ave., Garwood, N. J.

(*Continued on page* 284)

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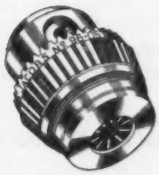
The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.

The Jacobs Rubber-Flex® Tap Chuck for tapping heads and impact tools.



The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.

The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use.

The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.

The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.

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Or write for *free* copies of Wheelock, Lovejoy Data Sheets. They contain complete technical information on grades, applications, physical properties, tests, heat treating, etc.

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American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Wales-Strippet Co., North Tonawanda, N. Y.

BORING TOOLS

Apex Tool & Cutter Co., Inc., 237 Canal St. Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Bliss, E. W., Co., 1375 Raff Road, S. W. Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BRASS

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

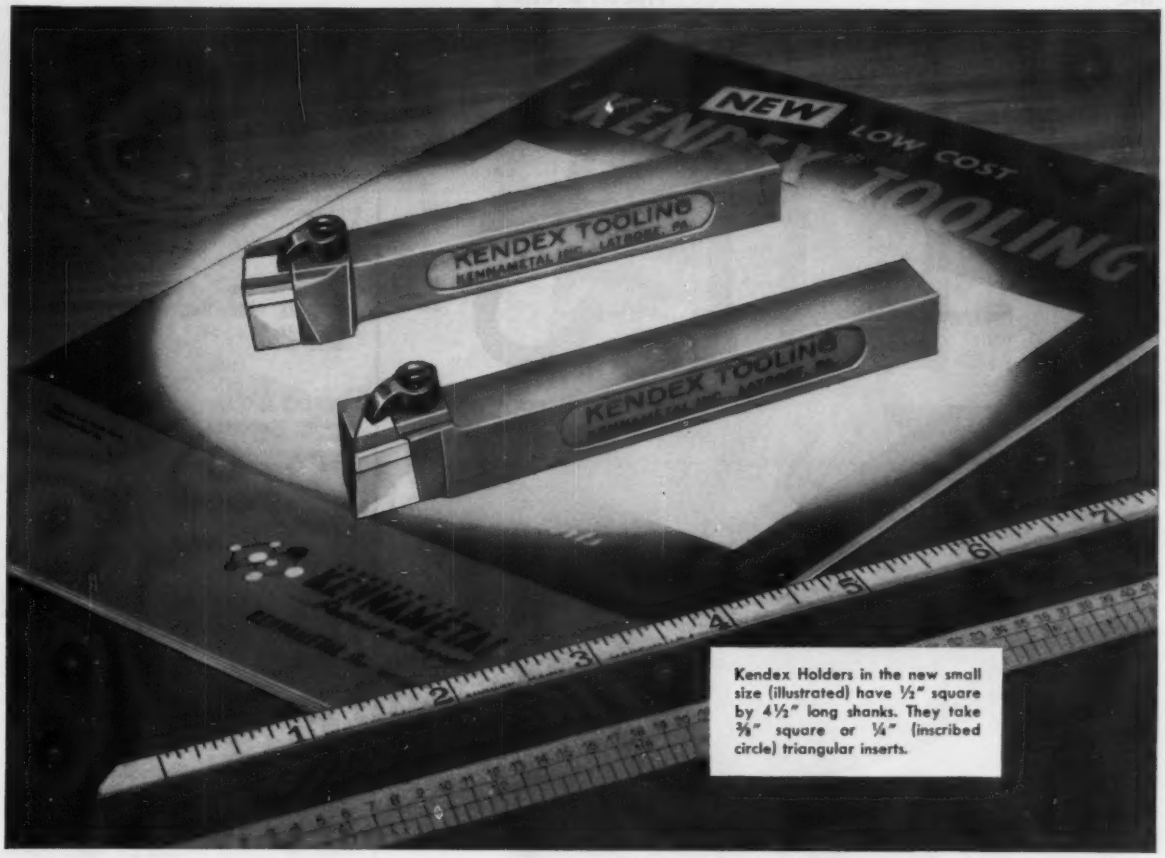
BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINE

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Detroit Broach Co., P. O. Box 156, Rochester, Mich.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.

(*Continued on page* 286)



Kendex Holders in the new small size (illustrated) have ½" square by 4½" long shanks. They take ⅜" square or ¼" (inscribed circle) triangular inserts.

NOW, small Kendex* Button Tools with turnover "throw-away" inserts

...for light machining on high production operations
...especially useful for boring operations

Another variation of the popular Kendex Tooling is now available. This is the new ½" Kendex Holder, available in four styles, for use with triangular or square Kennametal* "turn-over" button inserts . . . making available small tools with the many advantages and economies of the Kendex principle:

- grinding is eliminated
- inserts are indexed quickly to each new cutting edge
- machine downtime is reduced to a minimum
- production is increased

If you are interested in small-sized, rugged, dependable clamped-type tooling, ask your Kennametal tool engineer to show you how these small Kendex holders can be used to advantage on your operations. Or write for Booklet 301. KENNAMETAL INC., Latrobe, Pennsylvania.

Small-sized Kendex Tools are equipped with Kennametal chip breakers and solid Kennametal seats to back up inserts.

Kennametal inserts for small Kendex holders are stocked in a number of grades including the new K7H grade for high velocity operations and for machining heat-treated or high tensile steels.

Tell us your small-tool problem and our tool engineers will help you select the right tool and grade of cutting edge.

*Registered Trademark

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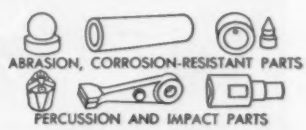
INDUSTRY AND KENNAMETAL ...Partners in Progress



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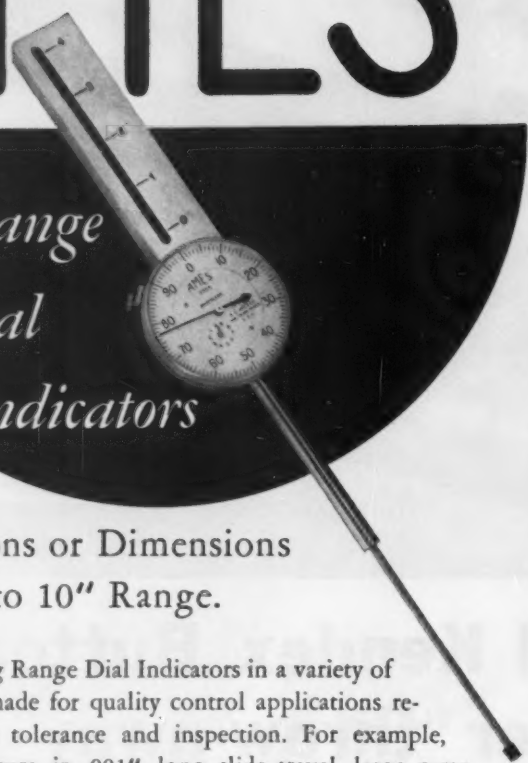
AMES

Long Range Dial Indicators



Check Motions or Dimensions In .001" up to 10" Range.

Ames Long Range Dial Indicators in a variety of models are made for quality control applications requiring close tolerance and inspection. For example, you can measure in .001", long slide travel, large cams, deep recesses or other dimensions requiring indicator spindle travel of up to 10".

In addition, Ames Long Range models have all the advantages that are built into Ames regular indicators:—dials of large diameter; easy-to-read, widely spaced graduations; movable dials; replaceable contacts. All Ames Long Range indicators have count hands to indicate revolutions of the indicator hand. Those with box covered, rack guide have a slot in the cover graduated to register each inch of spindle movement.

Write today, sending your problem in long range measuring. Ames will be glad to suggest a solution. Be sure to include drawings and specifications – your answer will be back faster if you do.

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MANUFACTURER OF MICROMETER DIAL GAUGES • MICROMETER DIAL INDICATORS

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Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE
American Brass Co., Waterbury 20, Conn.
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Bridgeport Brass Co., Bridgeport, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Erie Foundry Co., Erie, Pa.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BURS
See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Shenango-Penn Mold Co., Dover, Ohio.

BUSHINGS, Hardened
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1925 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS
Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

CAM CUTTING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sundstrand Machine Tool Co., 2351 11th St., Rockford, Ill.

(*Continued on page* 288)

PROFIT!

National Metal Exposition And Congress

PUBLIC HALL
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Oct. 8 thru 12

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You'll learn profitable ideas that will contribute to your future planning in many important ways. That's why this year's Metal Show is a must for management men, engineers, production and purchasing men **in your plant** . . . in fact, anyone you know who is concerned with metals should see this show and sit in on the sessions.

MORE THAN 100 TECHNICAL PAPERS are scheduled. Specialists will discuss their most recent findings. They will tell you what's new and coming in the metals field and how you can profit most from these modern achievements.

For the ideas you'll gain . . . for greater profit in the future . . . for all you'll see and learn . . . attend the 1956 Metal Show at Cleveland's Public Hall.

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National Metal Exposition
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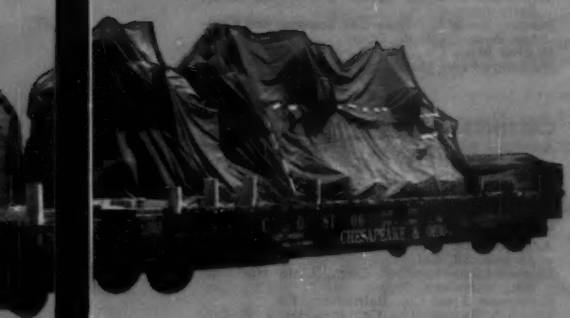
Delivery schedules of capital goods such as large, high-production machines present problems for machine tool builders. At Natco these problems are as serious as with any builder. But Natco's current record for on-time shipment is remarkably good . . . 86% either on schedule or better than schedule.

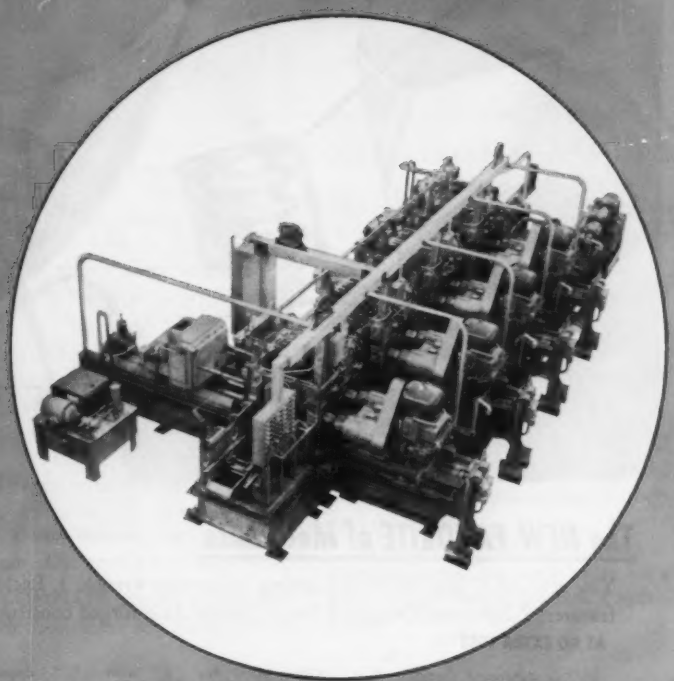
And we're not stopping there . . . we are adding 50% more production capacity to further improve our delivery schedules.

Production schedules of consumer products also present serious problems. With modern, high-production, cost-saving machine tools, many perplexing production schedules become routine.

Call in a Natco Field Engineer to discuss your next production problem. You can count on his recommendations *and* his delivery promises.

Shipped on Time





Multiple spindle drilling, boring, facing and tapping machines.
Special way-type, index and transfer machines.

Call Natco offices in Chicago, Detroit, Buffalo, New York,
Boston, Philadelphia, Cleveland and Los Angeles;
distributors in other cities.

Natco Holeway® transfer machine turns and faces 120 cylinder blocks per hour.

NATIONAL AUTOMATIC TOOL COMPANY, INC. ***Richmond, Indiana***

NATCO

Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan.

The NEW FAVORITE of Mechanics

You get "All-3" in a Williams Locking Adjustable wrench. 1. Exclusive features; 2. Advanced Design; 3. Sound precise drop-forged construction

AT NO EXTRA COST

Why accept less when you can get the best at:

$2.24	each	for	6"	with	3/4" capacity
$2.60	each	for	8"	with	15/16" capacity
$3.32	each	for	10"	with	1 1/16" capacity
$4.86	each	for	12"	with	1 5/16" capacity

Call your local industrial distributor for the fastest, low cost service

J. H. WILLIAMS & CO., 408 Vulcan St., Buffalo 7, N. Y.

WILLIAMS
INDUSTRIAL TOOLS
"The Broadest Line of Its Kind"

CAM MILLING AND GRINDING MACHINES

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CASEHARDENING FURNACES

See Furnaces, Heat-Treating

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.

American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.
Shenango-Penn Mold Co., Dover, Ohio.

CASTINGS, DIE

American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wisc.

CASTINGS, Iron

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Shenango-Penn Mold Co., Dover, Ohio.

CASTINGS, Steel, Alloys, Etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel

Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES

Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfeld, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

(*Continued on page* 292)

Talking About Die Sets

with
Phil Marsilius
Vice-President
The Producto Machine Co.

Master or Commercial: What Makes the Difference? The most obvious difference between a Master (Precision) set and a Commercial set is the price. The Commercial set costs less because less assembly time is required in its manufacture. Punch holder and die holder tolerances are the same for both grades of die set. However, extremely close tolerances for fit between pins and bushings on Master sets require more accurate honing of bushings in assembly. Master die set tolerances for parallelism between punch and die holder are also more critical than those for Commercial die sets.

Normally, the difference between pin and bushing diameters on die sets manufactured by our industry is never less than .0002" and ranges as high as .0009". There are die sets made to closer or looser tolerances than these, but generally speaking, the majority of die sets fall into this category.

Master die sets are manufactured to the low side of this tolerance scale and are held to a maximum of .0004" differential. This closer tolerance increases the useful life of precision sets by allowing for wearing of the pins and bushings in operation.

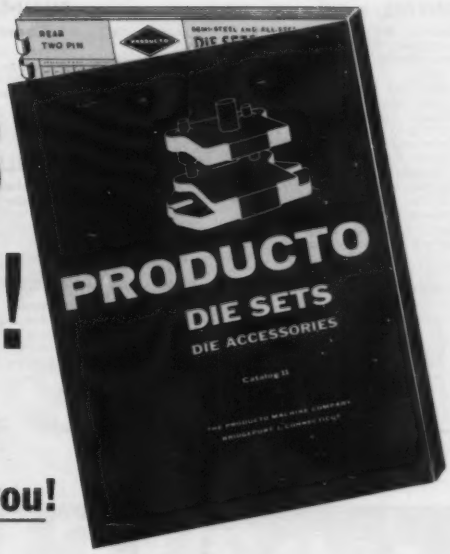
Commercial die sets are made throughout the entire range of this tolerance scale and, more often than not (to reduce assembly cost), are made to the higher tolerances. As a result, their accuracy will usually decrease much faster than that of Master die sets. While it is possible with this tolerance range to receive a Commercial set with the minimum pin and bushing fit allowed, you can be certain of longer die set accuracy only with a Master set, which is guaranteed to be held to the low side.

A "free-sliding fit" is one that permits the punch holder to move down on the guide pins of its own weight. It does not have any bearing on the degree of accuracy of the die set since a free-sliding fit can be supplied on both Master and Commercial sets. On Master sets, however, it is sometimes necessary to hone out the bushings to a full .0004" tolerance to provide a free-sliding fit.

EVERY die set MUST, of necessity, work freely in normal use, *on the press,* but catalog die sets should come apart and go together easily for bench work. With an occasional exception (when sets are made to the lowest tolerance for fit allowed), disassembly should be possible by hand without use of separating tools.

In making a choice, the degree of accuracy required and the life requirements of the die set should be the main points of consideration which determine whether you should order a Master or Commercial die set.

IT'S HERE!



A new catalog designed for you!

WRITE FOR YOUR COPY TODAY

Here, at last, is a die set catalog that makes your selection and ordering really easy. Producto's all-new catalog is compact for the die designer, convenient for the purchasing agent, a functional tool for the die maker.

These unique features make Producto's catalog much easier for you to use:

IT'S COMPACT. Though many items have been added, it has *fewer* pages because superfluous material has been eliminated. New products include Qwik-Fit Guide Pins, new Bushings with grease fittings, Lamina Bushings, Ring Punches and Dies, Toolroom Equipment, Lubrication Accessories and new Die Spring Selections.

IT'S COMPLETE, containing the greatest selection of die sets and accessories that has ever been offered to date.

ALL PRICES ARE NET and appear in a *separate pricing supplement,* removed from the technical section. No more time-consuming "discount" calculations.

NEW BINDING ARRANGEMENT lets you look at technical and pricing information *simultaneously.* No more flipping pages back and forth to get complete information.

STREAMLINED PAGE LAYOUT makes it easier for you to find essential data. Color highlights catalog numbers and drawings.

To make your die set ordering as painless as possible, write today for a free copy of Producto's new Catalog No. 11.

THE PRODUCTO MACHINE COMPANY
985 Housatonic Avenue, Bridgeport 1, Connecticut

Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

For more information fill in page number on Inquiry Card, on page 231

CENTERS, Lathe

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

CHUCKING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co. (Single and Multiple Spindle), 170 E. 131st St., Cleveland, Ohio.
Potter and Johnson Co., 1027 Newport Ave., Pawtucket, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfeld 7, Mass.

CHUCKS, Drill

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Chicago Tool & Eng. Co., 8389 So. Chicago Ave., Chicago, Illinois
Ettco Tool., Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis,
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear

Gleason Works, 1000 University Ave., Rochester, N. Y.
Horton Chuck, Windsor Locks, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Lathes, etc.

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Chicago Tool & Eng. Co., 8389 So. Chicago Ave., Chicago, Illinois (Milling Machine)
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

(*Continued on page* 294)

NOTICE
to users of spindles* that need repair or rebuilding

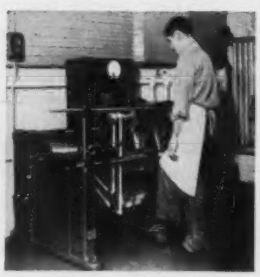
POPE — the leading builder of precision spindles IS THE BEST PLACE TO HAVE YOUR SPINDLES MADE GOOD AS NEW.

Today's grinding, milling and boring tolerances demand precision spindle performance.

Pope puts your spindles in shape *quickly*, at lowest cost. (Cost figures are promptly submitted for your approval before the work is done.)

The same expert craftsmen that build Pope Precision Spindles will assemble, preload and lubricate the proper bearings and dynamically balance. The job will be done *right* the first time.

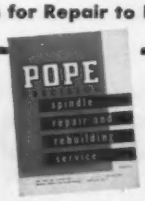
Send Your Spindles for Repair to POPE



Spindles repaired and rebuilt by POPE are assembled in an electrically air cleaned, air conditioned room. They are dynamically balanced, as pictured, to the same tolerances as new spindles. This assures better surface finishes and smoother running spindles.

* POPE Repair and Rebuilding Service applies to ANY SIZE, ANY MAKE of Anti-Friction Bearing SPINDLES.

Belt Driven
Motorized
High Cycle



POPE MACHINERY CORPORATION
261 River St., Haverhill, Massachusetts

Mail me a copy of Bulletin R-1 describing in detail Pope Precision Spindle repair and rebuilding service:

Name.....

Company.....

Address.....

City.....Zone....State.....

No. 114

POTTER & JOHNSTON

has the answers!

for example:

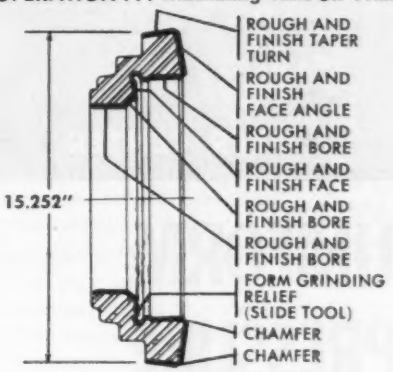
THE PROBLEM

BEVEL DRIVE GEAR
4629 STEEL FORGING
14 SEPARATE, CLOSE-TOLERANCE CUTS REQUIRED

THE ANSWER

FINISHED IN JUST 6.74 MINUTES
ON A P&J 6DREL-40 AUTOMATIC
with P&J-ENGINEERED TOOLING!

ONE OPERATION . . . Machining Time 6.74 Minutes



HEAVY LINES INDICATE MACHINED SURFACES

It's obvious, mathematically, that reducing the divisor in our formula will produce a bigger quotient . . . *your profit!* And it is equally obvious, from a practical point of view, that you can't solve *today's* machining problems profitably on machines built for yesterday's jobs. Here's a formula for profit proved in practice by dozens of manufacturers:

Modernize now with a P&J Automatic . . . like the 6DREL-40 . . . that has the speed, power and versatility to meet today's demands for faster, more accurate, lower-cost production. Team it with P&J-Engineered Tooling that takes full advantage of combined cuts and faster-cutting carbide tooling to reduce machining time to a minimum.

Start now . . . write on your Company letterhead for your copy of Bulletin No. 159 fully describing the P&J 6DREL-40 and 6DRE-40, and including complete engineering data.

Precision Production Tooling for more than Fifty Years

POTTER & JOHNSTON COMPANY

PAWTUCKET, RHODE ISLAND

SUBSIDIARY OF PRATT & WHITNEY COMPANY, INCORPORATED

MODERNIZE WITH POTTER & JOHNSTON . . . REPLACE FOR PROFIT

For more information fill in page number on Inquiry Card, on page 231

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety

Chicago Tool & Eng. Co., 8389 So. Chicago Ave., Chicago, Illinois
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

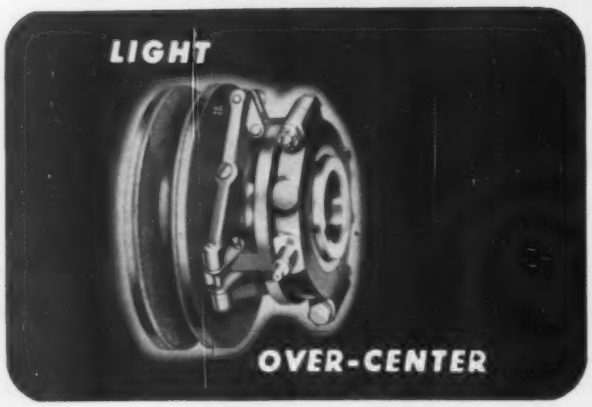
CHUCKS, Tapping

DoAll Co. 254 N. Laurel Ave., Des. Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.

ROCKFORD



UNIFORM PRESSURE

COMPACT DESIGN
POWERFUL PULL
SMOOTH ENGAGEMENT
UNIFORM PRESSURE *
FINE ADJUSTMENT
ACCURATE BALANCE
LONG SERVICE LIFE

*The driving pressure of this ROCKFORD toggle-action over-center CLUTCH is uniformly distributed—directly opposite the facing. The drive plate slides along an accurately machined collar, thus applying the pressure evenly. Plates are steel and facing is firm-grip, non-grab, long-life material.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD CLUTCH DIVISION BORG-WARNER
▲ 410 Catherine Street, Rockford, Illinois, U.S.A. ▲

CLUTCHES

CLAMPS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal

Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES

Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave. Warren, Ohio.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

COLLARS, Safety

Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los. Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence R. I.
Chicago Tool & Eng. Co., 8389 So. Chicago Ave., Chicago, Illinois
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Universal Engra. Co., Frankenmuth 2, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

COMPARATORS

See Gages, Comparator

COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lopping).

(*Continued on page* 296)

"They got Faster honing ... with ⅓ less stone pressure!"

A large manufacturer recently had a problem in engine cylinder honing after boring. Excessive time was required to bring the cylinder to the final dimension, and stone wear was high. The two honing oils being used seemed at fault.

R. J. Hughes, Sinclair Industrial Representative reports: "We made a routine call on their purchasing department at the time this situation was under study. They asked us for our solution. Based on previous experience with problems of this type, we recommended Sinclair HONOL® Light. The company agreed to test it."

DIAL READING REDUCED FROM 4½ TO 3!

"Test results were conclusive," continues Mr. Hughes. "On the same work, Sinclair HONOL Light substantially increased tool efficiency over the two competitive oils. Back pressure on the stone was reduced from a dial reading of 4½ to 3 ... a 33⅓% reduction ... *while accomplishing the same rate of removal!* Naturally, this company decided to convert all of their honing machines over to HONOL Light," concludes Mr. Hughes.

If you have precision honing machines it will pay to get the facts on Sinclair HONOL Oils. Contact your local Sinclair Representative, or write to Sinclair Refining Company, Technical Service Division, 600 Fifth Ave., New York 20, N.Y. *There's no obligation.*

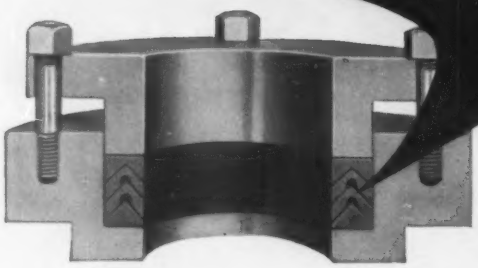
SINCLAIR

CUTTING OILS and COOLANTS

For more information fill in page number on Inquiry Card, on page 231

ONE OF THE GARLOCK 2,000

SHALLOW STUFFING BOXES NEED THIS KIND OF "GRIP"



GARLOCK 431 CHEVRON* PACKING

tightens as pressure increases, eases off as pressure decreases, assuring no-leak sealing and minimum friction on rams, plungers, reciprocating rods, etc.

LOOK AT THESE SERVICE REPORTS:

- On hydraulic press with 40" dia. ram, operating at 6000 psi pressure, .006" clearance between ram and gland, GARLOCK 431 CHEVRON size 40" x 41½" by only 2" deep gave 14 years service.
- On hydraulically operated clutches with ¾" cylinder, 500 psi pressure, ¾" travel, operating intermittently. Neither leather cups nor "O" rings worked well. Now packed with GARLOCK 431 CHEVRON ⅜" x ¾" x 17/32" deep. Result: smooth, positive sealing.

And remember, 431 CHEVRON Packing is only one of "the famous GARLOCK 2,000" . . . two thousand different styles of packings, gaskets, and seals to meet *all* your needs. It's the *only* complete line . . . it's one reason you get unbiased recommendations from your GARLOCK representative. Call him today or write for Folder AD-115.

*Registered Trademark

THE GARLOCK PACKING COMPANY,
Palmyra, New York

For Prompt Service, *contact one of our 30 sales offices and warehouses throughout the U.S. and Canada.*

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints

Oakite Products, Inc., 19 Rector St., New York, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

COMPOUNDS, Resin and Molding

Bakelite Co., Div. of Union Carbide & Carbon Corp., 30 E. 42nd St., N.Y., N.Y.
General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Blanchard Mch. Co., 64 State St., Cambridge Mass.
Columbus Die-Tool Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., 760 S. 13th, Newark 3, N. J.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Fellows Gear Shaper Co., Springfield, Vt.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Lees-Bradner Co., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett, Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfeld St., Dayton 1, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

CONTROLLERS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

COOLANT SEPARATORS

See Separators, Oil or Coolant

COOLANT SYSTEMS

Gray-Mills Co., 1948-52 Ridge Ave., Evanston, Ill.

COPPER

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

COUNTERBORES

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cello-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

(*Continued on page* 298)

For more information fill in page number on Inquiry Card, on page 231

A Variety of Work plus Transflex Feeding?

Ask JARECKI about the new CLEARING TRANSFLEX

Closeup of Transflex feed which is now adjusted to automatically feed an automotive valve cover stamping.

Today Jarecki Corporation is running valve covers on this new Clearing Transflex in their Grand Rapids Plant. Tomorrow? Who knows? Jarecki is a job shop with a wide variety of orders to fill and tomorrow may bring an automotive or appliance stamping run where delivery and quality are vital. That's why Transflex—Clearing's new concept of flexible automation—found immediate acceptance at Jarecki. Their new 600 ton press gives them the advantages of automatic transfer feeding, yet it's no single-purpose machine. Feed fingers change easily to accommodate different sized parts; the feed stroke is adjustable to take a wide range of jobs. Knockouts are universal and cushions also adjust laterally in the bed. If you have need for increased efficiency in your stamping operation, but have always thought of transfer presses as single-purpose machines, find out about Transflex. Call on a Clearing engineer for the full story.

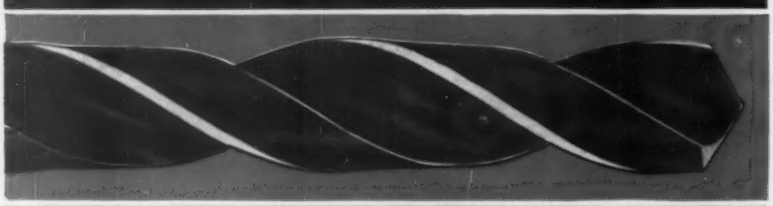
CLEARING PRESSES

THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION • **Division of U. S. Industries, Inc.**
6499 W. 65th Street, Chicago 38, Illinois • **Hamilton Plant, Hamilton, Ohio**

Chicago Latrobe

High Speed Drills



THE QUALITY THAT DELIVERS

greater cutting mileage!

SERVICE YOU CAN COUNT ON TO

eliminate down time!

Virtually all high-speed drilling jobs can be done by an in-stock Chicago-Latrobe Drill. So whatever your needs—look to Chicago-Latrobe. You'll find their line is complete, their quality tops, and their service unexcelled.

Order Chicago-Latrobe tools from a *service-minded* Industrial Distributor in your area.

CHICAGO-LATROBE
W. ONTARIO STREET, CHICAGO 10

DOUBLE CIRCLE TOOLS

DRILLS · REAMERS
COUNTERSINKS · COUNTERBORES
CARBIDE TOOLS · SPECIAL TOOLS

Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 52nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Starrett, The L. S., Co., Athol, Mass.
Threadwell Tap & Die Co., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

COUNTERSHAFTS
Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS
Besly-Welles Corp., 112 Dearborn Ave., Beliot, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

COUNTERS, Revolution
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

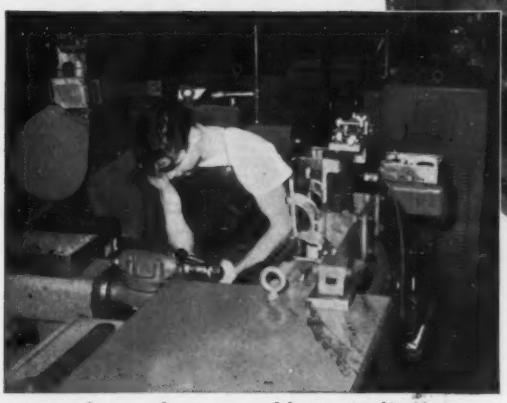
COUNTING DEVICES
Starrett, The L. S., Co., Athol Mass.

COUPLINGS, Flexible
Boston Gear Works 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.

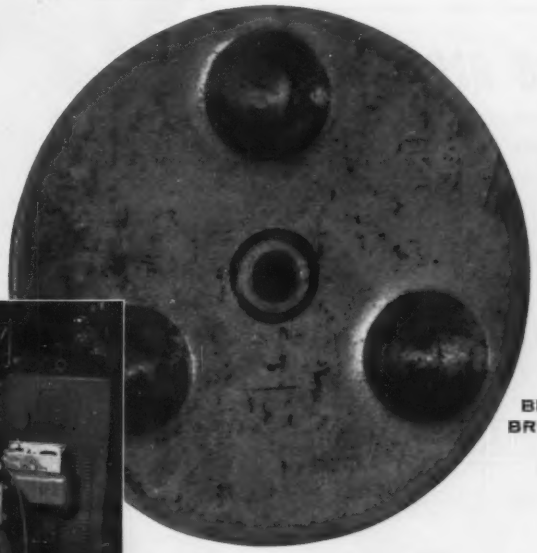
COUPLINGS, Shaft
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co. 7171 E. McNichols Rd., Detroit 12, Mich.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling
Cleveland Crane & Engrg Co., Wickliffe, Ohio.

CUTTER GRINDERS
See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.
(*Continued on page* 300)



A manufacturer of computers and business machines improves the quality of precision components, greatly reduces costs using Osborn Brushamatic machines.



BEFORE BRUSHING

AFTER BRUSHING

Low price on high finish

A few years ago, precision parts were finished in custom lots at considerable cost. Today, Osborn power brushing methods put finer finishes on precision parts at mass-production rates.

The business machine component shown above is typical. Brushamatic® Machines put a high, mirror-like finish on all flat and depressed surfaces of this ball retainer in just 25 seconds—*finish 6 parts for the former cost of finishing 1.*

An **O**sborn **B**rushing **A**nalysis, made in your plant at no obligation, will show how *you* can use Brushamatic® methods to produce finer finishes at lower cost. Write THE OSBORN MANUFACTURING COMPANY, DEPT. D-45, 5401 HAMILTON AVENUE, CLEVELAND 14, OHIO.

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

For more information fill in page number on Inquiry Card, on page 231

There are many

FANTASTIC

ways . . .

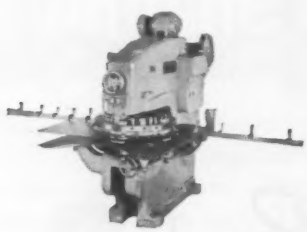
to Produce Holes

in Flat Sheet Metal and Plate

. . . but cost conscious production men use WIEDEMANN Turret Punch Presses

You will save money with a Wiedemann on your short run piercing operations. In fact, a Wiedemann will cut your piercing costs 60% to 90%—because a Wiedemann means . . . no set up . . . no layout . . . reduced handling . . . low cost, on-the-spot engineering changes.

It will pay you to get the facts about the Wiedemann Method. Write today for Bulletin 101, or, better yet, send typical drawings of your work for a free time study and a recommendation of the press and tooling best suited for your needs.



From the small, hand operated R-2 to the 150-ton Turret Punch Press, there's a Wiedemann designed for your short run piercing needs.

WIEDEMANN MACHINE COMPANY

4205 Wissahickon Ave. P.O. Box 6794 Philadelphia 32, Pa.

CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Twist Drill & Tl. Co., Rochester, Mich.
Waltham Mch. Works, Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greefield, Mass.
Ex-Cello-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chi-Mich.
Tomkins-Johnson Co., Jackson, Mich.
Wesson Co. 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Rotary

See Files & Burrs Rotary

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.

(*Continued on page* 302)

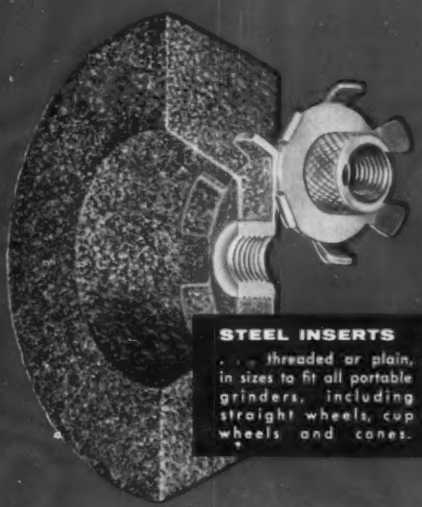
For more information fill in page number on Inquiry Card, on page 231

SIMONDS
ABRASIVE CO.

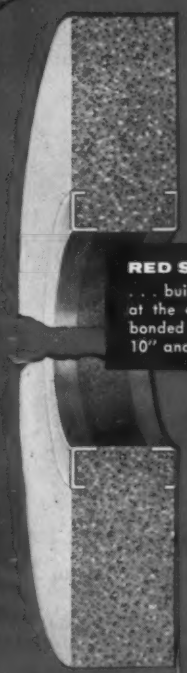
GRINDING WHEELS... with *improved bushings* for better grinding

TRUFIT
. . . a resin-impregnated fiber sleeve in the center hole, principally for resinoid bonded wheels for portable grinders.

POLYSTYRENE
. . . injection molded plastic material replacing conventional lead bushing, chiefly for tool room wheels such as 7 x ½ x 1¼.



STEEL INSERTS
. . . threaded or plain, in sizes to fit all portable grinders, including straight wheels, cup wheels and cones.



RED STREAK FLANGES
. . . built-in circular steel flanges at the center hole. For resinoid bonded snagging wheels with 6", 10" and 12" hole sizes.

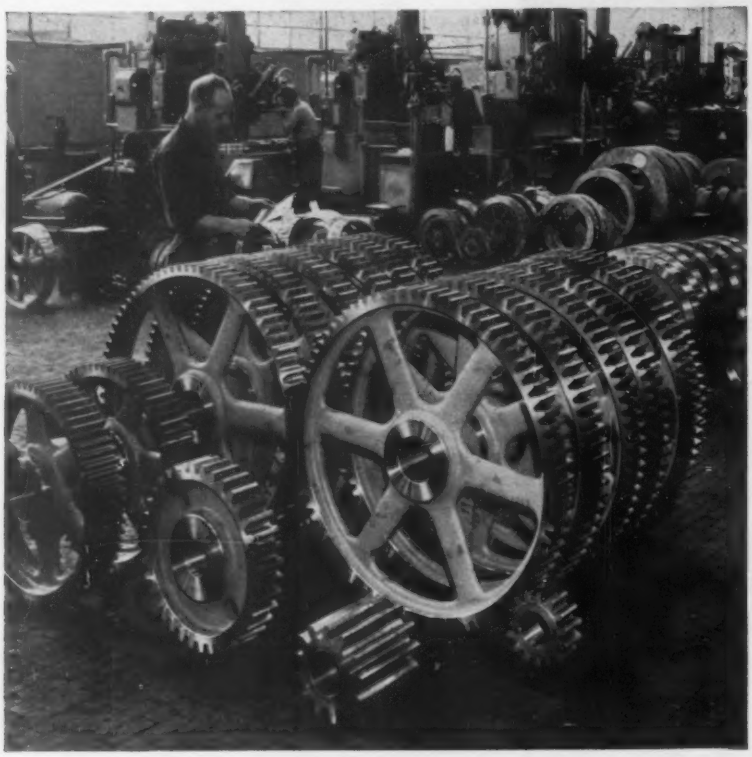
KARVIT
. . . a hard, non-metallic material with a smooth surface, replaces lead or plain holes, principally for precision grinding wheels.

Better, more economical grinding! Simonds literally "centers" on this with these improved bushings. For you, this means better grinding efficiency . . . in terms of better spindle fit, better balance, truer running, less wear on spindles and center mounts and better work produced.

Put all these advantages to work for you by specifying Simonds Abrasive Co. Wheels on all your grinding jobs.

SIMONDS ABRASIVE COMPANY • PHILADELPHIA 37, PA.

Branch Warehouses: Boston, Detroit, Chicago, Portland, San Francisco. Distributors in Principal Cities
Division of Simonds Saw and Steel Co., Fitchburg, Mass.



DESTINATION -Soaking Pits

These H&S steel spur gears will soon be lifting soaking pit covers for a leading steel producer. (We cut spur gears up to 144" outside diameter and 1 D.P.)

Similar large H&S custom-built spur gears have proved their dependability by serving Industry for over 50 years. Rugged construction and exact machining of all H&S gears assure quiet operation, uniform velocity ratio and freedom from vibration.

Let our years of experience in the engineering and manufacture of all types of gears be your assurance of an unbiased recommendation for the best solution to your requirements. Contact your H&S representative or send us your power transmission inquiries today.

THE HORSBURGH & SCOTT CO.
GEARS AND SPEED REDUCERS
5112 Hamilton Avenue
Cleveland 14, Ohio

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Landis Machine Co., Waynesboro, Pa., (Pipe).
Lewis Machine Co., 3441 E. 76th St., Cleveland, 27, Ohio
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio

CUTTING-OFF MACHINES, Abrasive Wheel
Campbell Machine Div., American Chain & Cable, Bridgeport, Conn.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hamilton Div., The Lodge & Shipley Co., Hamilton 1, Ohio.

CUTTING-OFF MACHINES, Cold Saw
See Sawing Machines, Circular

CUTTING-OFF MACHINES, Metal Band Saws
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.

CUTTING-OFF TOOLS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York N. Y.
Kennametal, Inc., Latrobe, Pa.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo.

CUTTING-OFF WHEELS, Abrasive
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Farley Sts., Philadelphia 37, Pa.

CYLINDER BORING MACHINES
Baker Bros., Inc., Sta. F, Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2424 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Detroit 34, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

CYLINDERS, Air
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Logansport Machine Co. Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Shenango-Penn Mold Co., Dover, Ohio.
Tomkins-Johnson Co., Jackson, Mich.

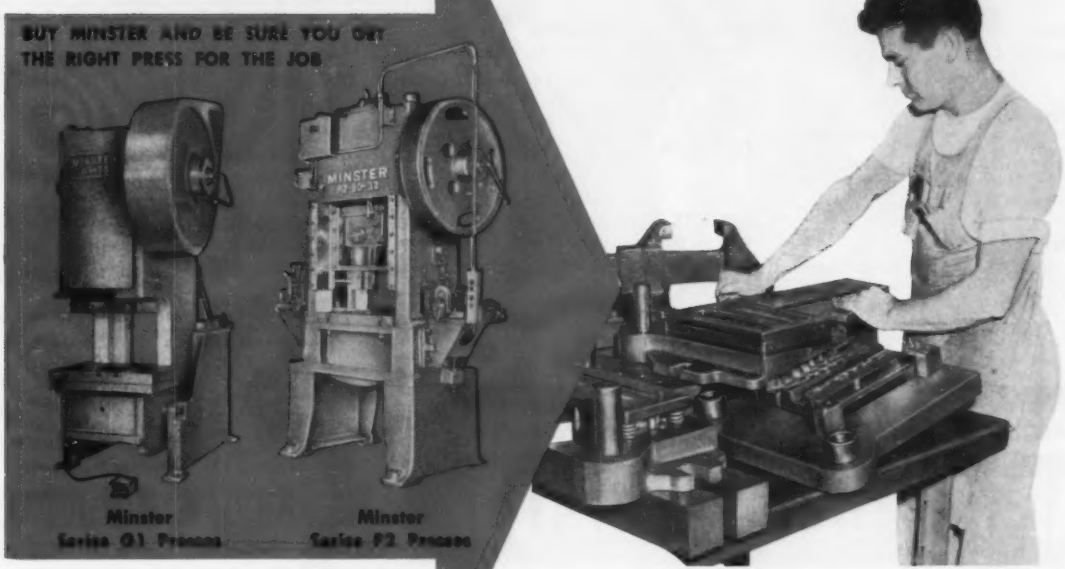
CYLINDERS, Pneumatic
Shenango-Penn Mold Co., Dover, Ohio.

DEALERS, Machinery
Falk Machinery Co., 18 Ward St., Rochester, N. Y.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

(*Continued on page* 304)

A Minster Press means

LESS DIE REPAIR



These Minster Press features *protect* dies from needless expensive repairs.

1. Rugged Minster Frames assure the greatest rigidity with the least possible deflection.

2. Accurate alignment of slide face and bed is assured by Minster Design. Beds scraped to surface plate. Long slide ways scraped square to slide face. Gibs accurately ground and adjusted for proper clearance using ground spacers on all front gibs of presses over 60 tons.

3. Minster bearing bushings honed to proper clearance thus reducing impact shock and snap-thru backlash.

4. Minster patented Combination Air Friction Clutch and Brake has smooth shock absorbing action which tends to reduce die wear caused by impact. Fast controlled engagement or disengagement on 360° surfaces gives opportunity for operator to stop slower presses before dies close in case of misfeed. It also makes possible the use of precision switches in dies to anticipate misfeeds on automatic operations and stop press before serious damage occurs.

Build a sound replacement program modernize with Minster Presses

THE MINSTER MACHINE COMPANY

MINSTER, OHIO

MINSTER®

PRESSES

For more information fill in page number on Inquiry Card, on page 231

DEMAGNETIZERS
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Walker, O. S. Inc., Worcester, Mass.

DESIGNERS, Machine and Tool
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Specialty Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co. 14230 Birwood Ave., Detroit 4, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DIE-CASTING
See Castings, Die

DIE-CASTING MACHINES
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.

DIE CUSHIONS
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St. Chicago, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Kennamental Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.

DIEMAKERS' SUPPLIES
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Producto Mch. Co., 990 Housatonic Ave., Brdgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mach. Co., Oakley, Cincinnati 9, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.

DIE SETS, Standard
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridegport, Conn.
U. S. Tool Co., Inc., 225 N. 18th St., Ampere, N. J.
Wales-Strippet Co., North Tonawanda, New York

DIE-SINKING MACHINES
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.

DIE-SINKING PRESSES
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

DIE STOCKS
See Stocks, Die

DIES, Lettering and Embossing
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

DIES, Sheet Metal, Etc.
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mach Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Niagara Mch. & Tool Wks., 683 Northland Ave., Buffalo, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Co., North Tonawanda, New York
Waltham Mch. Wks., Newton St., Waltham, Mass.

DIES, Threading
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.

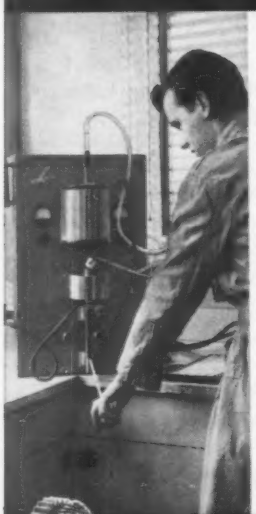
DIES, Threading, Opening
Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

DIES, Thread Rolling
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

(*Continued on page* 306)

Another of the Reasons Behind Brad Foote Quality—

CARBON DETERMINATION



• In hardening gear teeth by carburizing, carbon content and depth of penetration are vitally important. BRAD FOOTE insures precise control of these factors through metallurgical tests with equipment developed specifically for this purpose.

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• Carbon determination tests are only one of many metallurgical controls that insure the uniform quality of BRAD FOOTE Gears. Metallographic examination, hardness testing, chemical analysis—these are just a few of the quality checks provided by BRAD FOOTE's completely equipped metallurgical laboratories.

• Add these precise controls to specialized production and heat-treating equipment and a wealth of detailed experience in producing gears of all types—you begin to appreciate why BRAD FOOTE can produce better quality gears at substantial savings.

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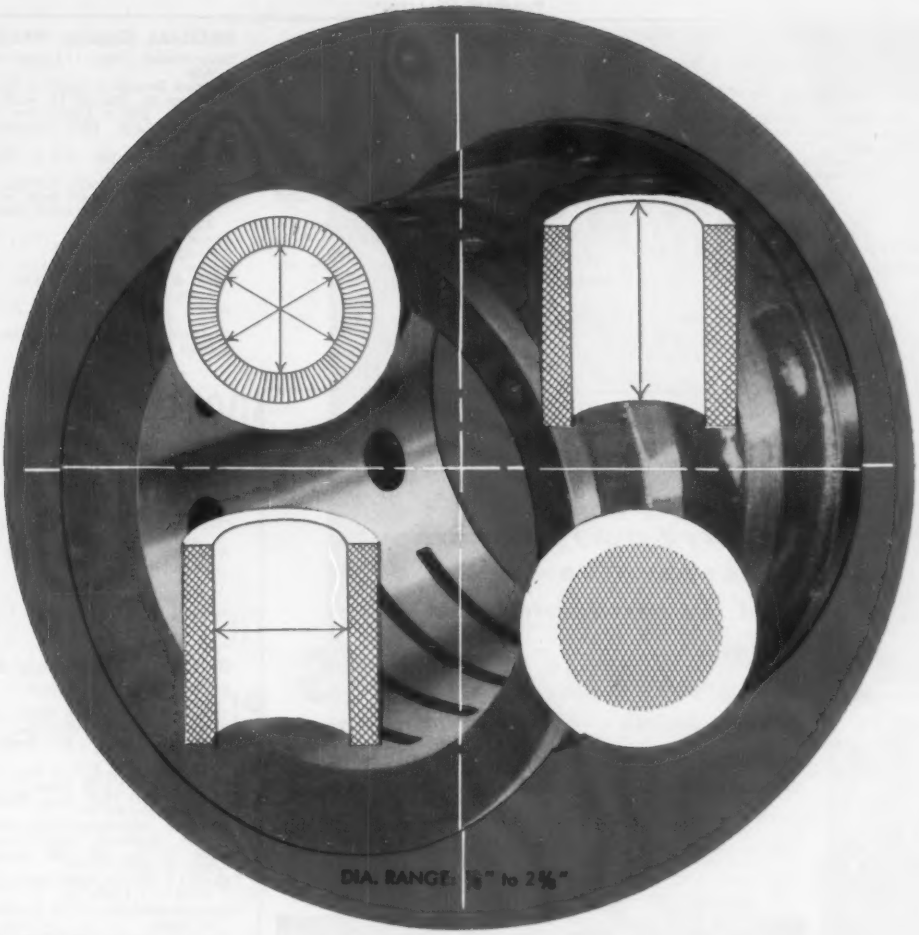
subsidiaries | AMERICAN GEAR & MFG. CO. Lemont, Illinois - Phone Lemont 920 • PITTSBURGH GEAR COMPANY Pittsburgh 23, Penn. - Phone SPalding 1-4600

D Product Directory



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DISCS, Abrasives

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Thor Power Tool Co., Aurora, Illinois
Wells Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

DISINTEGRATORS

Elox Corp., 602 N. Rochester Rd., Clawson, Mich.

DIVIDING HEADS

See Indexing and Spacing Equipment

DOWEL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRESSERS, Grinding Wheel

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Colonial Broach & Machine Co., P. O. Box 37, Harper St., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

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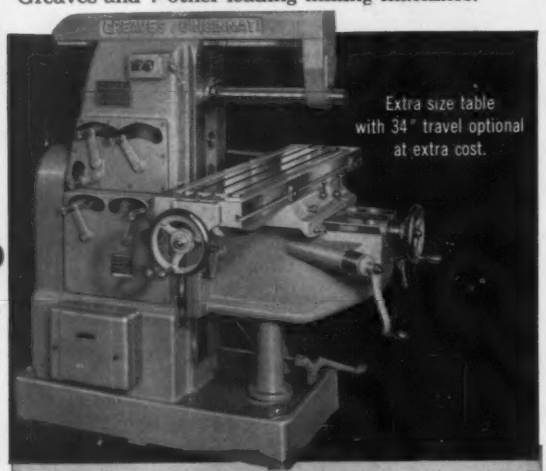

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DRIFTS, DRILL

Armstrong, Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Govro-Nelson Co., 1933 Antoinette St., Detroit 8, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6302 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kiswaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Illinois

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page* 308)

News from Hamilton!

100 to 300 ton press line sets new standards

Here's Hamilton's brand new high-speed 250-ton, double-crank press with 60" x 36" bed and slide

For the first time in the industry, Hamilton gives you 100 to 300 ton presses built to meet exacting automotive production standards . . . standards pioneered in the automotive field through more than thirty years of Hamilton press leadership.

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- barrel-type motorized slide adjustment
- automatic lubrication
- pneumatic flywheel brake
- die lights
- die cushions
- pneumatic counterbalances
- interlocked electrical clutch control

Exact specifications are adjustable to your individual requirements. Special electrical controls are available to meet particular electrical standards.

It will mean money in your pocket to find out today how these all-new Hamilton presses can help you turn out high quality stampings fast . . . without costly production downtime. Get the full story on these new standards for 100 to 300 ton presses . . . from Hamilton Division, BLH Corporation, Hamilton, Ohio.

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DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLING MACHINES, Automatic

Avey Drilling Mach., Co., 26 Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridegport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kingsbury Mch. Tool Corp. Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippet Co., North Tonawanda, New York
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Bench

Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 126 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

DRILLING MACHINES, Boiler

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

DRILLING MACHINES, Deep Hole

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippet Co., North Tonawanda, New York

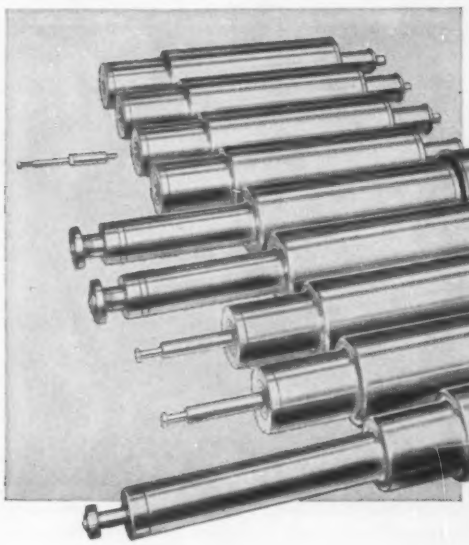
DRILLING MACHINES, Gang

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Horiz.

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.

(*Continued on page* 310)



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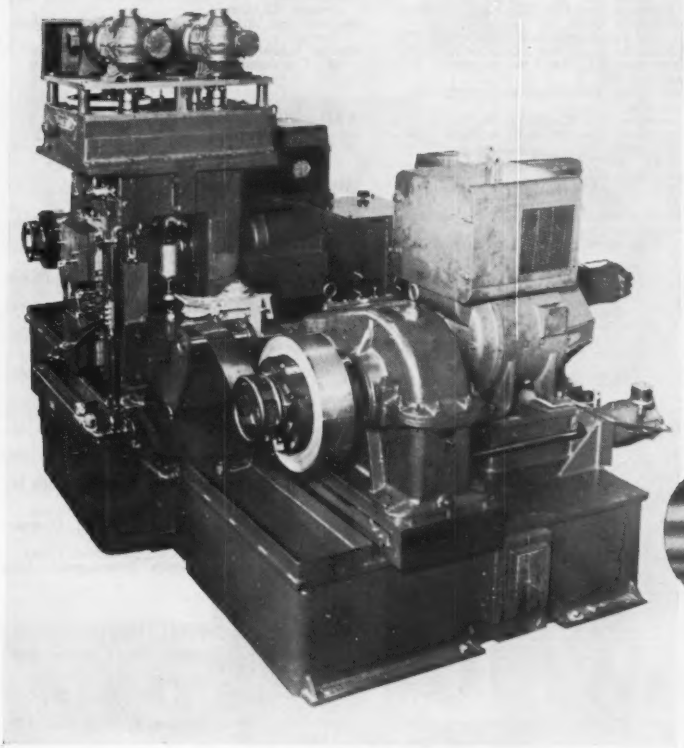

Model 210 4-High Rolling Mill, manufactured by H. J. Ruesch Machine Co., Newark, N. J.

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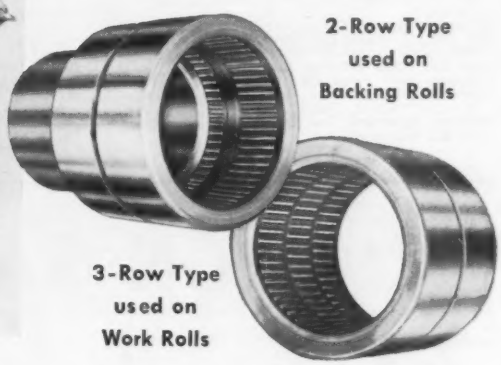

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Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill
Townsend, H. P., Mfg. Co., Elmwood, Conn.

DRILLING MACHINES, Horizontal Portable

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Multiple Center Column Type

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.

DRILLING MACHINES, Multiple Spindle

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14320 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.

DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Manufacturing Co., Bellwood, Illinois
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Wales-Strippet Co., North Tonawanda, New York

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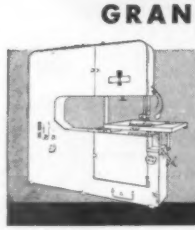

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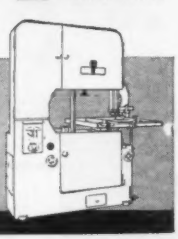

DRILLING MACHINES, Upright

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Manufacturing Co., Bellwood, Illinois
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St. South Bend, Ind.
Wales-Strippet Co., North Tonawanda, New York

DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works, 3817 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

(*Continued on page* 312)

VERSATILE

MILL-M-MATIC for Accurate, Heavy Duty Production Milling . . . .

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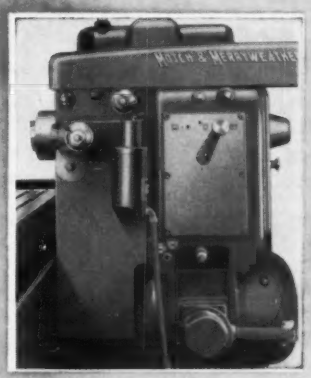
All machine functions within easy reach. All-electric, automatic controls built to conform with J. I. C. standards.

. . . for POWER

25 Hp. Anti-Friction Spindle Drive

Heavy duty milling head driven by large bull gear through involute spline. Extra wide bearing surface in housing when quill is fully extended.

. . . for QUICK, QUIET OPERATION



Hardened, ground gearing. Helical change gears for quick speed selections. Automatic spindle stop. 2-way automatic table cycles.

All the features of Mill-M-Matic point up to high, accurate production. A fresh approach employing control by electric-mechanical powered action opens new possibilities in long life and precision operation in the field of *production milling*. Our 10-page bulletin describes all the advantages found in Mill-M-Matic.

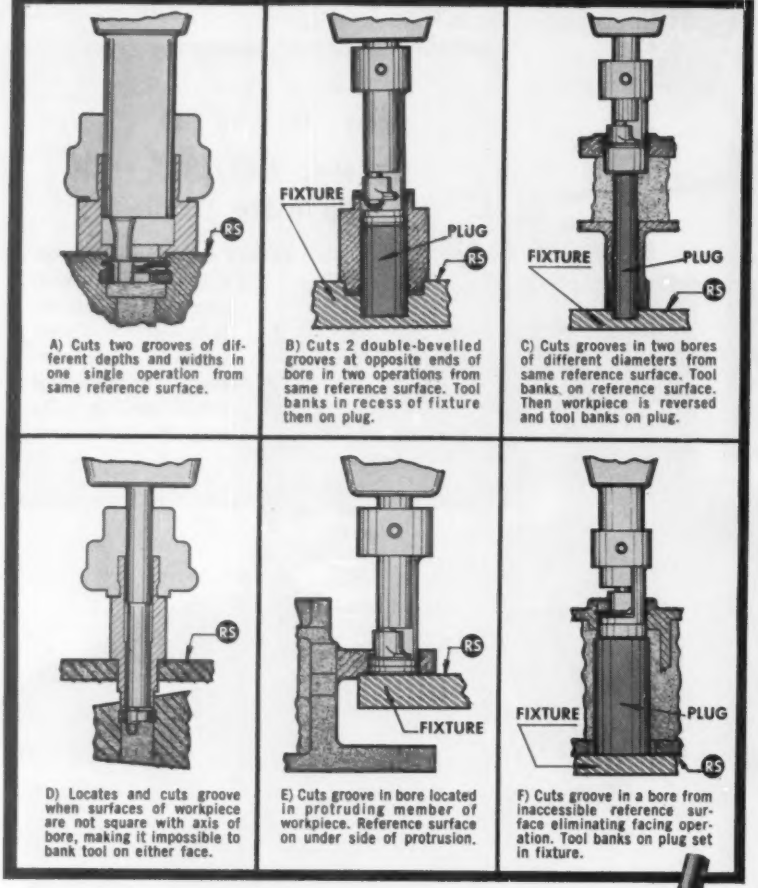
The MOTCH & MERRYWEATHER Machinery Co.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

For more information fill in page number on Inquiry Card, on page 231

Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



A) Cuts two grooves of different depths and widths in one single operation from same reference surface.

B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.

C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.

D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.

E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.

F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

Amazingly versatile! Your toughest recess cutting problems can be met simply and efficiently with the Waldes Truarc Grooving Tool because it offers a whole range of possibilities beyond the range of ordinary recessing tools.

Wide Cutting Range! The Waldes Truarc Grooving Tool comes in 5 models...enabling you to cut accurate grooves in housings with diameters from .250 to 5.00 inches.

Send Your Problems to Waldes! Send us your blueprints...let Waldes Truarc Engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job. There is no obligation!

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Waldes Truarc Grooving Tool Manufactured Under U. S. Pat. 2,411,426

Waldes Kohinoor, Inc., 47-16 Austel Pl., L.I.C. 1, N. Y.
Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool. (M 098)
Name
Title
Company
Address
City Zone State

DRILLS, Center

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL, Core

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Deep Hole

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Star Cutter Co., Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati Ohio.
Thor Power Tool Co., Aurora, Illinois.

DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Illinois

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

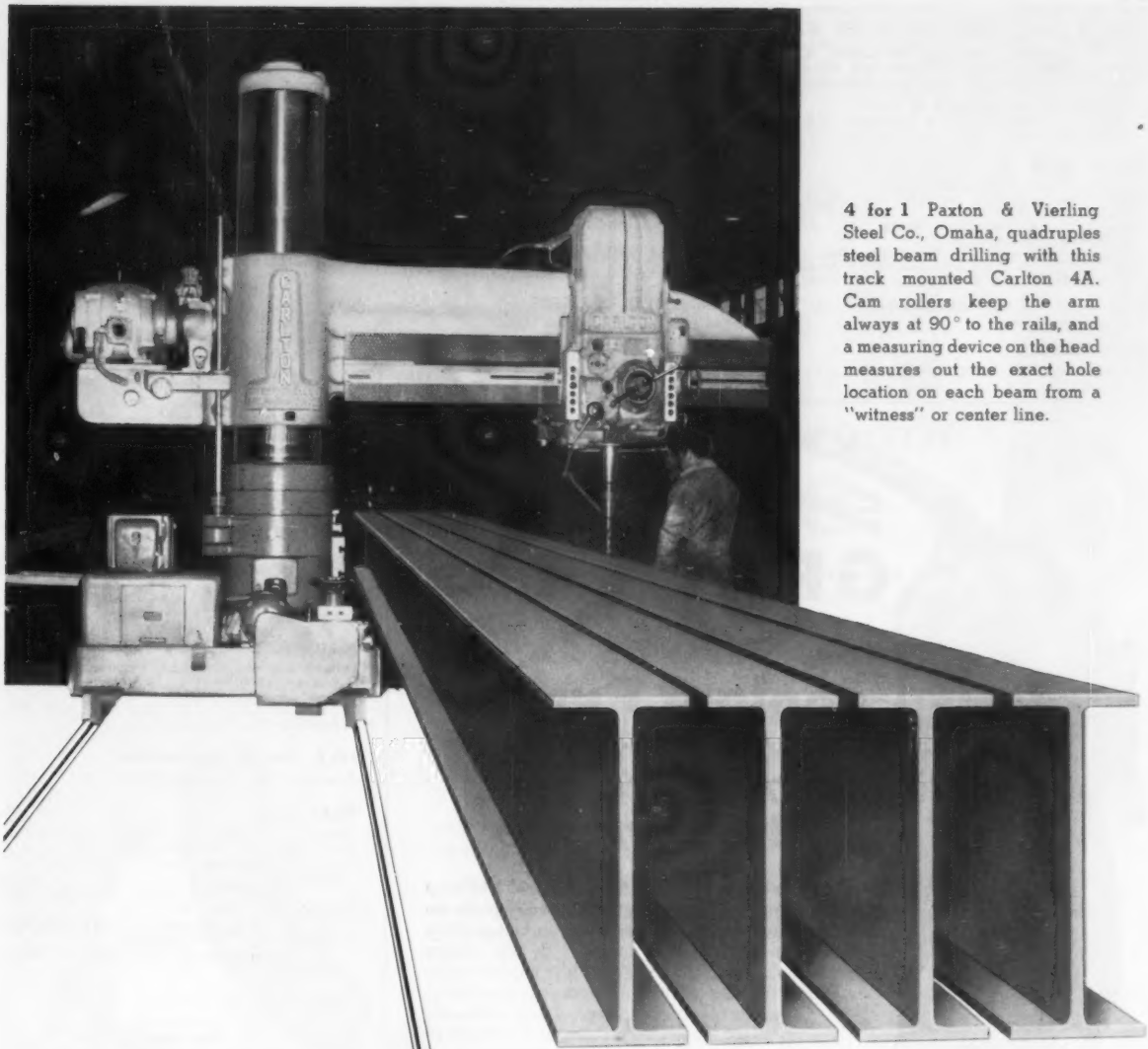
DRILLS, Subland

Ace Drill Corp., Odrian, Michigan.
pelier, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.

(*Continued on page* 314)



4 for 1 Paxton & Vierling Steel Co., Omaha, quadruples steel beam drilling with this track mounted Carlton 4A. Cam rollers keep the arm always at 90° to the rails, and a measuring device on the head measures out the exact hole location on each beam from a "witness" or center line.

structural steel drilled more efficiently with Carlton track mounted radial drills

Special track mounting takes Carlton's drilling facilities up and down the entire length of even the longest beam. 10-ft. or 100. And Carlton's long arm reaches out over several beams.

Multiple beam drilling is but one advantage of these mobile Carlton radial drills which also offer—at no extra cost: 3-unit power clamping, low-hung drive, positive tooth feed clutch, and easy economical operation and maintenance. Made in five models and many arm and column sizes. Write for descriptive bulletins. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton radial drills in arm lengths 3-ft. to 12-ft., column diameters 9" to 26". Also 4H and 5H horizontals.

Carlton
radial and horizontal drills

For more information fill in page number on Inquiry Card, on page 231

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfeld, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Spiral Step Tool Co., Chicago 25, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATORS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

DUST COLLECTORS

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS

Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT

General Electric Co., Schenectady 5, N. Y.

EMERY WHEEL DRESSERS

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EMERY WHEELS

See Grinding Wheels

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Put your hand on a Graymills Superflo Coolant Pump when it's pumping . . . feel that smooth, quiet performance that results from careful balance, perfect-positive alignment and the floating impeller design. Listen carefully too . . . you can barely hear it in a quiet room.
Here is a pump that complements the finest machines—Rugged, Dependable, Abrasive-Proof. Top rated motors, newly designed simplified mounting and electrical connections—obvious quality, but priced right, too. Get the facts on Graymills Superflo Coolant Pumps today, as well as our unusual original equipment sales policy. For your replacement needs, superflo pumps are sold through Industrial Distributors everywhere.
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Designed and priced for Machine Builders' use
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Series Thirty ¼ HP 20 GPM 15' Head
Series Forty ½ HP 36 GPM 15' Head
Series Fifty ½ HP 65 GPM 15' Head

END MILLS

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.

ENGRAVING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1110 W. 13th St., Racine, Wis.

EXTRACTORS, Screw

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic

Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Federal Press Co., Elkhart, Ind.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FELT, For All Applications

American Felt Co., Glenville, Conn.

FILES, Hack

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Oliver Instrment Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Commercial Filters Corp., Lebanon, Indiana
Cuno Engineering Corp., Meriden, Conn.
Industrial Filtration Co. (Delpark Corp.), 15 Industrial Ave., Lebanon, Ind.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

FILTERS, Fire-resistant Fluids

Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

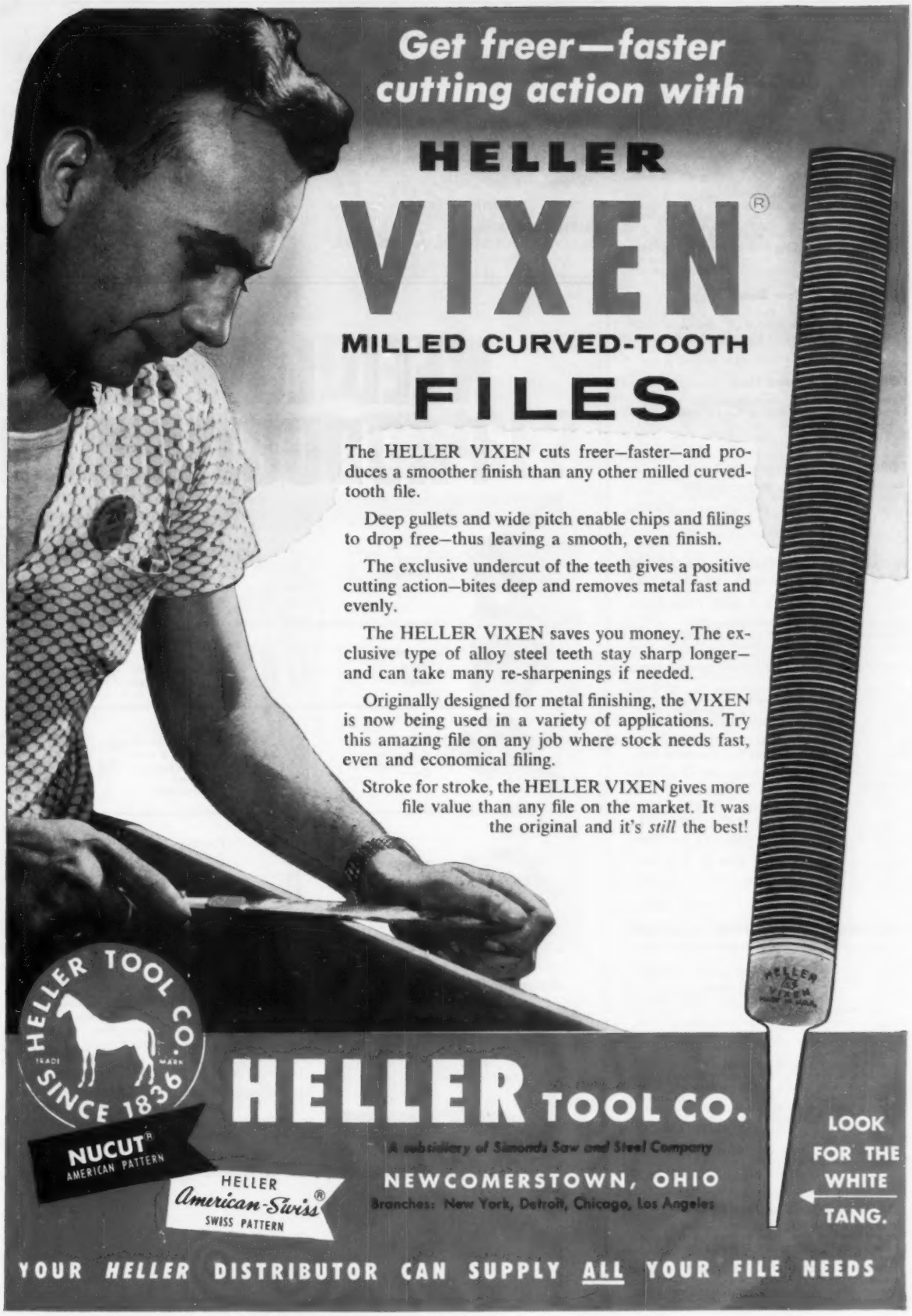
FILTERS, Hydraulic Oils

Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

FILTERS, Water

Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

(*Continued on page* 316)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FLEXIBLE COUPLINGS

See Couplings, Flexible

FORGINGS, Machines (Upsetting)

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

FORGINGS, Drop

Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored

Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel

Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset

Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

FORMING AND STAMPING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Federal Press Co., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
U. S. Toc Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametel, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded

Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

FURNACES, Heat-Treating

Ajax Electric Company, Philadelphia, Pa.
General Electric Co., Schenectady 5, N. Y.
Holcroft and Co., 6545 Epworth Blvd., Detroit 10, Mich.

FURNITURE, Shop

Standard Pressed Steel Co., Jenkintown, Pa.

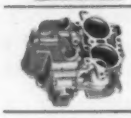
GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air

Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

NEED LOW-COST, PRODUCTION OF

Part	No. of Stations	Operations		Production
Cover Cylinder Front	4	19 drilling 3 boring 6 chamfering 6 tapping 1 reaming	TOTAL 35	137 pcs./hr.
 Carburetor Main Body	6	15 drilling 3 counterboring 1 tapping 1 spotfacing	TOTAL 20	375 pcs./hr.
Water Pump Cover	6	12 drilling 2 milling 3 boring 2 chamfering 4 reaming 1 counterbore	TOTAL 24	177 pcs./hr.
Throttle Body for Four Barrel Carburetor	6	7 drilling 2 countersinking 3 spotfacing 6 reaming 1 tapping 1 milling 1 chamfering	TOTAL 21	375 pcs./hr.

Morris provides "Special Machines"

...at a fraction of the usual "Special Machine" price!

Morris

These precision operations are performed on Morris Unit-Type Production Machines . . . at only pennies per part! Morris Custom Engineering Service develops the equivalent of a "Special Machine". . . using standard basic and automatic drilling units . . . at a fraction of the usual "Special Machine" price!

This fast, accurate, production method may be applicable to your products. Write for information, or outline your production problem for analysis by Morris engineers.

THE MORRIS MACHINE TOOL COMPANY
946 Harriet Street Cincinnati 3, Ohio

GAGES, Comparator

Ames, B. C., Co., Waltham 54, Mass
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.

GAGES, Depth

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1927, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GAGES, Height

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Plug, Ring and Snap

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Surface

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Thread

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R.I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Winter Bros. Co., Rochester, Mich.

GASKETS

Crane Packing Co., 6400 Oakton St., Morton Grove, Illinois
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic

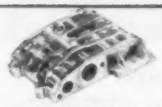
General Electric Co., Schenectady 5, N. Y.

GEAR BURNISHING MACHINES

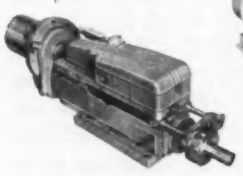
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

(*Continued on page* 318)

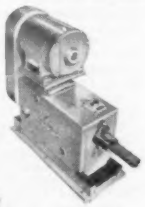
HIGH SPEED PARTS LIKE THESE?

Part	No. of Stations	Operations		Production
Refrigeration Compressor Crankshaft	12	10 drilling 1 gun drilling 1 chamfering 2 milling	TOTAL 14	121 pcs./hr.
 Automatic Transmission Control Valve Upper Body	8	4 drilling 3 tapping 3 reaming	TOTAL 10	188 pcs./hr.
Air Horn Four Barrel Carburetor	6	18 drilling 2 reaming 1 countersinking 1 spotfacing 1 tapping	TOTAL 23	375 pcs./hr.
Refrigeration Compressor Cylinder Housing	18	4 milling 19 drilling 11 burring 4 counterboring 3 reaming 3 spotfacing 10 tapping 3 boring 1 chamfering	TOTAL 58	120 pcs./hr.

MORRIS Automatic Drilling Units



AIR-OIL-MATIC



CAM-MATIC

MORRIS High Production Machine 18 station

For more information fill in page number on Inquiry Card, on page 231

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES

Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield Vt. (Straight and Hourglass Types).
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR TESTING MACHINERY

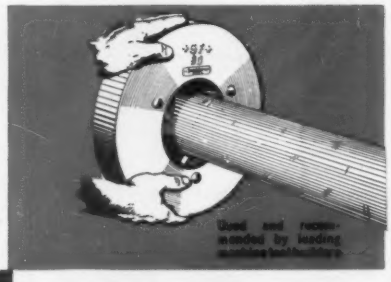
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

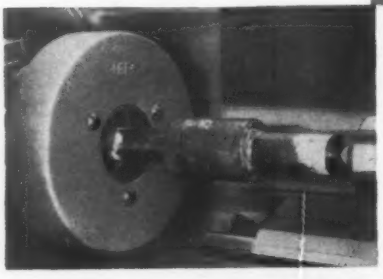
GEARS, Cut

Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Wks., 1309 So. Cicero Ave., Chicago 50, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrell-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Lees-Bradner Co., Cleveland, Ohio.

(*Continued on page* 320)

SKINNER
+GF+
WORK DRIVERS





the best for turning on centers

They're fast, powerful — the ideal means for driving smooth or rough bars and forgings located on centers! Jaws are easily reversed to accommodate direction of spindle rotation. Five sizes handle work from ¼" to 8 1/16" diameter.

- ½ turn does the clamping — no wrenches needed
- Each size has wide clamping range • Cuts clamping and unclamping time • Clamps out-of-round work evenly
- Clamping force always matches cutting pressure.

Write Skinner or your Skinner distributor for folder.

THE CREST OF QUALITY

THE SKINNER CHUCK COMPANY
206 Edgewood Ave., New Britain, Conn.

MORE DIE CASTING - LESS SCRAP

New H-P-M Ups Production For Basic Aluminum Castings Co.

"By moving several jobs from a conventional toggle type machine to our new H-P-M, we reduced scrap loss to a minimum . . . at the same time we increased production." This report from T. M. Byrne, President, Basic Aluminum Castings Co. of Cleveland is typical. H-P-M die casting machines are doing an outstanding job for die casters throughout the country and here are the reasons why: They are designed to entirely new theories of metal injection and clamping. The new exclusive hydraulic-mechanical link-wedge clamp has plenty of "beef"—clamp locks die firmly to rated capacity and better. "Beef" limits die parting on overload during metal injection. Results—flash and scrap loss reduced to a minimum . . . quality parts produced to accurate dimensional tolerances. The new injection end has unlimited plunger motion control . . . exceptionally high speed. Call in an H-P-M engineer today and let him give you the complete facts before you buy. You'll be glad you did.

Watthour meter socket cast in a single cavity die on an H-P-M 400-ton die casting machine at Basic Aluminum Castings Co. This is a 1½ pound shot. Production—140 an hour.

HPM

THE HYDRAULIC PRESS MFG. CO.

Mount Gilead, Ohio, U.S.A.

A DIVISION OF KOEHRING COMPANY

For more information fill in page number on Inquiry Card, on page 231

Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

GEARS, Rawhide and Non-Metallic

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cincinnati Gear Co., Wooster Pike and Marlemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

GEARS, Stamped

Winzeler Mfg. & Tool Co., 1712 W. Arcade Pl., Chicago 12, Ill.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

GRADUATING MACHINES

Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Machines, Carbide Tool

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Madison-Kipp Corp., Madison, Wis.
Thor Power Tool Co., Aurora, Illinois.

GRINDERS, Portable Electric and Toolpost

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Thor Power Tool Co., Aurora, Illinois.

GRINDING FIXTURES

Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sterling Grinding Wheel Co., Tiffin, Ohio
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

GRINDING MACHINES, Broach

Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

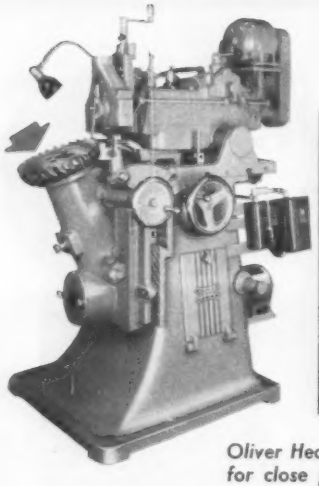
GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

(*Continued on page 322*)

Extremely Accurate . . .
Fully Automatic . . .
Hydraulically Operated . . .

THE Oliver FACE MILL GRINDER



- EXCLUSIVE! THE ONLY MACHINE THAT AUTOMATICALLY GRINDS THE FACE, CORNER RADIUS OR CORNER ANGLE, LEAD ANGLE, AND ALL NECESSARY CLEARANCES SIMULTANEOUSLY.
- EXTREME ACCURACY . . . CLOSE TOLERANCES ARE HELD THROUGH AUTOMATIC FIXED LINE GRINDING.
- TOOL ROOM HOURS SAVED . . . GRINDS CUTTERS 6 TO 8 TIMES FASTER.
- THREE STANDARD MACHINES—CAPACITIES: 6″ to 16″ DIAMETERS . . . 8″ TO 18″ DIAMETERS . . .10″ TO 21″ DIAMETERS.

Oliver Heavy-Duty Hand Operated Face Mill Grinder for close pitch cutters and Oliver Arc Radius Cutter Grinders are also supplied. Write for complete details.

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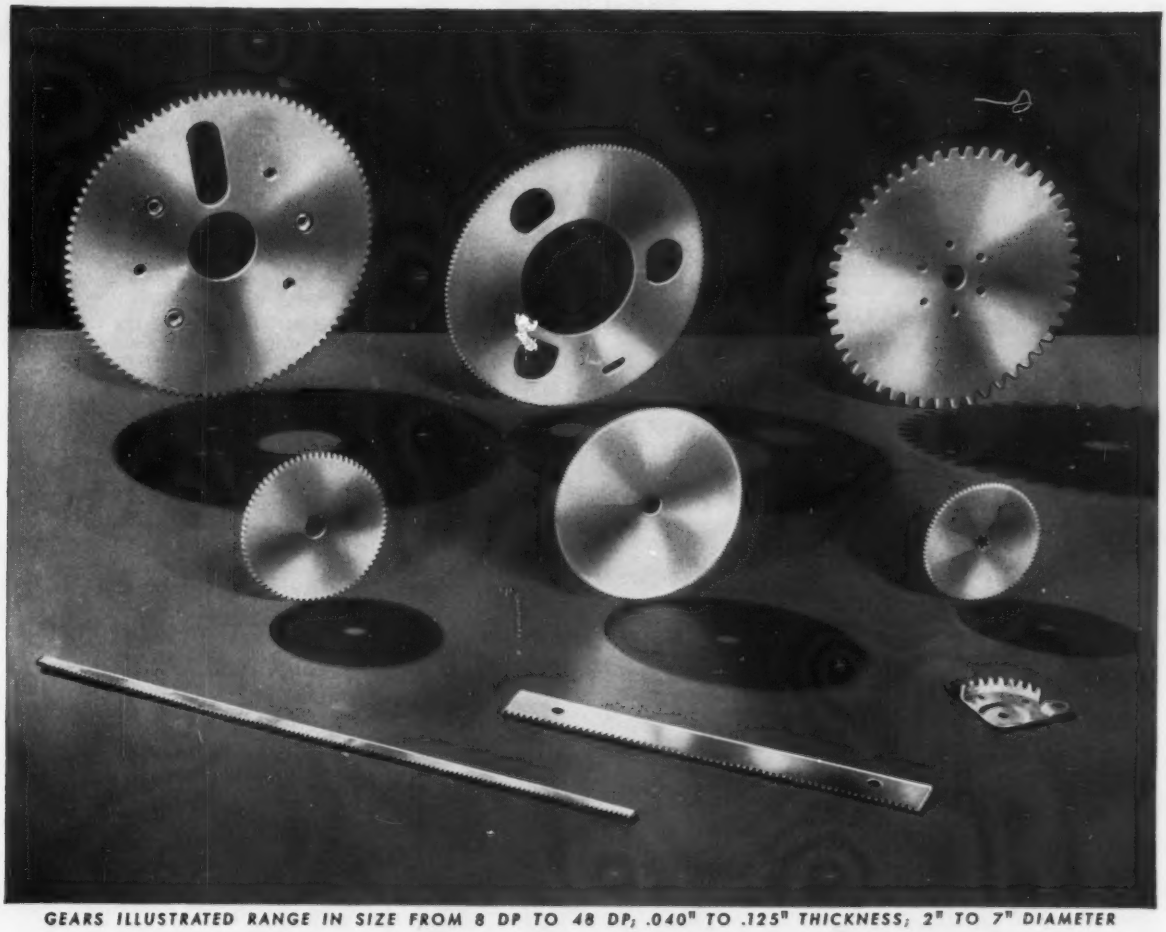
FACE MILL GRINDERS • AUTOMATIC DRILL GRINDERS • DIE MAKING MACHINES
TOOL & CUTTER GRINDERS • DRILL POINT THINNERS • TEMPLATE TOOL GRINDERS



GEARS ILLUSTRATED RANGE IN SIZE FROM 8 DP TO 48 DP; .040" TO .125" THICKNESS; 2" TO 7" DIAMETER

HOW TO CUT ASSEMBLY TIME AND GEAR COSTS!

Assembly lines *flow faster* with Winzeler Stamped Gears. Down-time headaches disappear. Finished assemblies run S-M-O-O-T-H . . quiet. And they last longer, too.

Gaining greater accuracy and all-round quality in *Stamped* Gears has been a specialty of ours for years. Improved modern methods of Tooling, Stamping, and Assembling have resulted in a new high degree of precision that remains *uniform* in high speed, mass-production runs. Regardless of the quantity of Gears you need, you can depend upon WINZELER Stamped Gears to *consistently* measure up to the most exacting specifications. Your own assembly operations will soon reflect the savings made possible by these better, more uniform Stamped Gears.

WINZELER research has cut Gear costs, too. Now, for many applications, single stampings can be laminated and indexed to produce wider faces at savings up to 60%!

We stamp Gears in production runs, in sizes from 120 to 8 dp, and from .006 to 3/16" thickness . . and up to 7" diameter. Tell us about your needs. Send drawings or descriptions today. Ideas and low cost estimates incur no obligation.

WINZELER Stamped Gears

MAIL THE COUPON FOR FREE STAMPED GEAR FOLDER

WINZELER MANUFACTURING & TOOL CO.,
1712 WEST ARCADE PLACE, CHICAGO 12, ILLINOIS

Gentlemen:

Please mail to me, at once, a copy of the free WINZELER Stamped Gear folder.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

For more information fill in page number on Inquiry Card, on page 231

GRINDING MACHINES, Carbide Tool

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GRINDING MACHINES, Centerless

Cincinnati Grinders Incorporated, Cincinnati 9, Ohio
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Chucking

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders Incorporated, Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Drill

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDING MACHINES, Face

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment

GRINDING MACHINES, Gap

Cincinnati Grinders Incorporated, Cincinnati 9, Ohio
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines

GRINDING MACHINES For Sharpening Cutters, Reamers, Hobbs, Etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

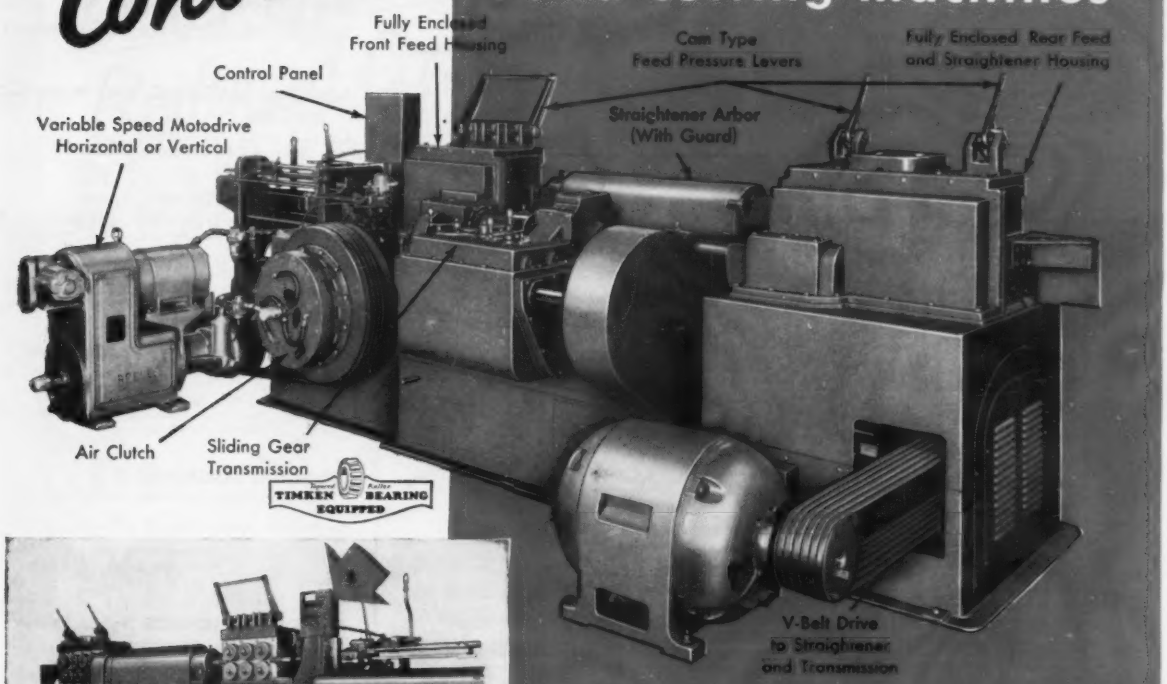
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.

(*Continued on page 324*)

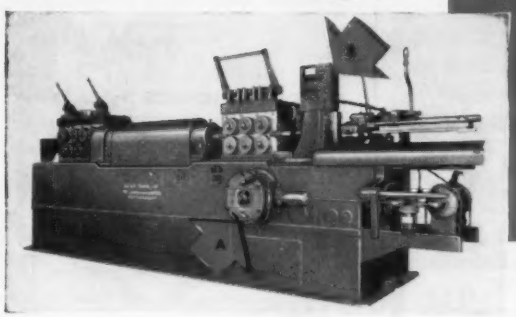
For automatic metal-cutting . . .
Use CIRCLE R
CARBIDE SAWS
For controlled quality in automated production, especially where extra tough cutting prevails, Circle R Carbide Saws are your reliable choice. The best you can buy, yet costing no more, they ensure longer runs, less down time, fewer stoppages for re-sharpening. Comparative records prove they greatly increase production rates. Refer to our Catalog H for an inclusive line, both carbide tipped and solid tungsten carbide.
Controlled quality in automated production
Consult CIRCLE R Specialists in —
BURBANK CHICAGO CLEVELAND DAYTON DETROIT
HACKENSACK INDIANAPOLIS KANSAS CITY MILWAUKEE
NEW YORK CITY PHILADELPHIA MONTREAL PHOENIX
PITTSBURGH PROVIDENCE ROCHESTER ST. LOUIS WESTBURY, L. I.
METAL SLITTING SAWS
COPPER SLITTING SAWS
SCREW SLOTTING SAWS
COMMUTATOR SLOTTING SAWS
JEWELERS' SLOTTING SAWS
CUT OFF SAWS • CIRCULAR KNIVES & ROTARY SHEAR BLADES • CIRCOLOY STEEL SAWS • SOLID & TIPPED TUNGSTEN CARBIDE SAWS
COMBINED DRILLS & COUNTERSINKS • CENTER REAMERS
CIRCULAR TOOL CO., INC.
PROVIDENCE 5, RHODE ISLAND
Specialists in Circular Cutting Tools Since 1923

Better Quality Control ✳

LEWIS introduces the Air Clutch on wire straightening and cutting machines


Fully Enclosed Front Feed Housing
Control Panel
Variable Speed Motodrive Horizontal or Vertical
Cam Type Feed Pressure Levers
Fully Enclosed Rear Feed and Straightener Housing
Straightener Arbor (With Guard)
Air Clutch
Sliding Gear Transmission
TIMKEN BEARING EQUIPPED
V-Belt Drive to Straightener and Transmission

No. 11-F Travel-Cut with Flying-Shear Cut-off. Capacity ⅛" to ⅜" diameter. 75-135 feet per minute. Rear view (above) with guards removed showing air clutch and drive.



Front view of No. 11-F Travel-Cut with Flying Shear Cut-off showing Air Brake "A" (with guard removed) and operating panel "B" with push-button controls for Air Clutch, Reeves Motodrive and flywheel speed Indicator Tachometer.

● Lewis engineers have added three important improvements to their famous Travel-Cut Machines for BETTER QUALITY CONTROL . . . These machines are already in service in America's leading steel and wire mills.

✳ Wichita Air Clutch permits higher cut-off speeds, eliminates shock of conventional clutch. No adjustment necessary . . . automatically compensates for wear.

✳ Wichita Air Brake eliminates conventional mechanical drag brake and is only engaged for a short portion of the cut-off cycle.

✳ Reeves Variable Speed Motodrive permits infinite adjustment of flywheel speed for perfect synchronization of the cut-off and wire feed speeds. This unique arrangement makes possible the cutting of rod WITHOUT SPOT SWELL . . . allows finer adjustment for cutting short lengths. Dial tachometer registers flywheel speed.

There are Standard Lewis Travel-Cut or Stationary-Cut Machines designed to straighten and cut all materials and shapes in wire or rod from .012" to ¾" at a wide range of feed speeds.

Air Clutch available on all Travel-Cut Models. Send for new brochure showing complete line of Lewis Wire Straightening and Cutting Machines.

See our Air Clutch equipped machine in operation at the Metal Show, Cleveland, Oct. 8-12, Booth No. 2002

LEWIS MACHINE COMPANY 3440 East 76th Street Cleveland 27, Ohio

For more information fill in page number on Inquiry Card, on page 231

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Michigan

GRINDING MACHINES, Internal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Springfield Machine Tool Co., Springfield, Ohio
Standard Electrical Tool Co., 2448-90 River Rd., Cincinnati, Ohio.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Moore Special Tool Co. Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney Co., Inc., West Hartford, Conn.

GRINDING MACHINES, Knife and Shear Blade

Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Piston Ring

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio

GRINDING MACHINES, Profile

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Sheffield Corp., 721 Springfield St. Dayton 1, Ohio.

GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Radial

Consolidated Mch. Tool Corp., Rochester, N. Y.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Cincinnati Grinders Incorporated, Cincinnati 9, Ohio
Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.

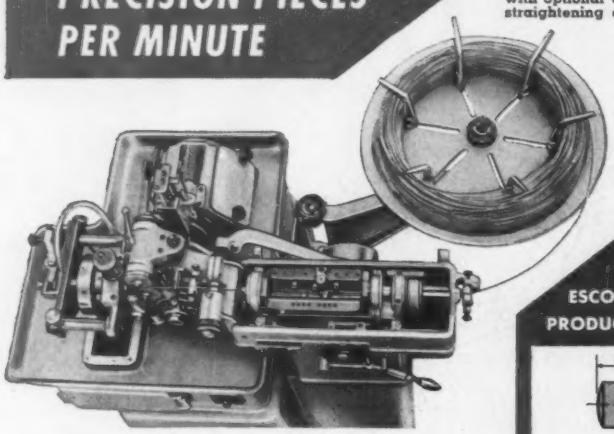
GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

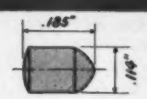
(*Continued on page* 326)

GET UP TO 100 SMALL PRECISION PIECES PER MINUTE

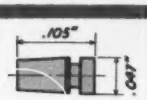
Below: ESCO ROTOMATIC DS 2 with optional wire-straightening attachment



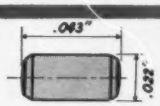
TYPICAL ESCO ROTOMATIC PRODUCTION RATES



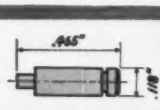
100/min.—brass



63/min.—nickel-silver



50/min.—nickel



10/min.—mild steel

PARTS UP TO 5/32" DIA. X 1" LONG MACHINED AS CLOSE AS ± .00025" FROM COILS OR BARS

A Swiss automatic form-turning and cut-off machine with optional wire-straightening attachment—you get high-speed production from coils or bars of any length. Coil-feeding speeds and economizes your operation by eliminating bar ends and bar loading time. Machining is done by two cutting tools mounted in a cam controlled tool head. The tool head rotates around material which is fed, guided, and clamped by a collet and a guide bushing. Machined parts are smooth, straight and *entirely burr-free* when they are delivered to the tray *separate from the chips.*

Get more information today about this machine and see how it can boost your production and cut your costs.

COSA — nationwide sales and service of precision machine tools — from bench lathes to boring mills.

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

IN CANADA contact COSA CORPORATION OF CANADA LTD., 1160 Lakeshore Rd., Long Branch, Toronto 14

Here's Your Best Assurance of

Higher Output Better Accuracy Reduced Costs

On Every Boring and Facing Operation . . . . .

TWO-CUTTER BLOCK WITH EXPANDABLE CUTTERS
MICROMETER-ADJUSTABLE SINGLE-CUTTER BLOCK
MULTI-CUTTER BLOCK WITH EXPANDABLE CUTTERS
SOLID BLOCK CUTTER

With only two items to handle —block and taper lock screw—it takes but a few seconds to insert a Davis block in its bar and start boring.

ONLY DAVIS GIVES YOU ALL 8 OF THESE ADVANTAGES

1. *Block centers accurately in bar.*
2. *Full thrust transmitted to bar.*
3. *Readily adjusts to float boring.*
4. *Cutters rigidly locked in block.*
5. *Assure maximum range of bore sizes.*
6. *Blocks feature built-in centers.*
7. *Fore or back bore with one tool.*
8. *Quick, easy changing of blocks.*

FOR COMPLETE INFORMATION, WRITE FOR DAVIS CATALOG 304

All 4 Block Styles Fit into the Same Bar Slot

Every boring job in your shop goes faster, more accurately and shows up far better on cost records when you standardize on Davis block tooling.

Truer bores result from exclusive design features and simplified, precision construction. The unique Davis double-piloted, taper lock screw is unequalled for accurate centering of block and transmission of full boring thrust to the bar slot. Rigidly supported and locked cutters assure higher accuracy on even heaviest cuts.

Faster, more economical boring results from the complete interchangeability of the Davis block line. Four basic block styles can be used in any particular bar slot—and changing blocks is simpler and faster than any other method. Bring your boring operations up to date—write now for complete information on how Davis Interchangeable Block Tooling can save you time, money and rejects.

DAVIS

BORING TOOL DIVISION OF
Giddings & Lewis Machine Tool Co.
Fond du Lac, Wisconsin

THE ONE NAME THAT CERTIFIES ULTIMATE PRECISION AND PRODUCTIVITY IN TOOLING

NEW *all-steel* ERIE

RIGIDROP

New design piston-lift gravity drop hammer with

New variable stroke control

More guiding surface for closer-tolerance forgings

Safety-streamlined, economical all steel construction

Experienced hammer operators will take quickly to the definite working advantages of this new Erie Rigidrop. It is a brand new concept in a simple-to-operate all-steel production hammer—striking more blows per minute, more easily, and with finer control than ever before realized. Certain shops will find this the most economical hammer they can use in their operations.

Most appreciated in Rigidrop's action is its ability to control stroke variation. This is not simply a short stroke feature, but a *new variable stroke control* allowing you to get *all the range* of strokes between the conventional short and long. Its treadle operates as simply as the accelerator on your automobile—for short fast blows, just press lightly; for longer strokes, apply more foot pressure as desired. And . . . your operator can instantly shift from short strokes to longer, and shift back again just as quickly.

There are many more features of the Rigidrop which will appeal to cost-conscious shops. We'll gladly have an experienced Erie Foundry representative call on you to explain its application—just ask.

Now available in sizes 1500 thru 5000 lbs., inclusive

40% more guiding surface—New Erie guide arrangement provides more accurate guiding of ram and continued maintenance of die adjustment.

Adjustable guides—Guide-Ram adjustments easily made from front and back of Rigidrop at close-to-floor level. Ram can be removed from the hammer at die level, without jacking.

Safety designed throughout—No loose linkage, no overhanging parts on the front of the Rigidrop. An air cushion head provides added protection if the hammer is overstroked.

Built-in inching mechanism—For easy die setups.

Better clamping system—Clamp faces are directly opposite one another to give positive clamping action without bending the rod.

Minimum down time—Never any board replacements.

SINCE 1895—THE GREATEST NAME ERIE *IN FORGING HAMMERS*

ERIE FOUNDRY CO. ERIE, PA.

For more information fill in page number on Inquiry Card, on page 231

GRINDING MACHINES, Thread
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GRINDING MACHINES, Universal
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders Incorporated, Cincinnati 9, Ohio
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Springfield Machine Tool Co., Springfield, Ohio

GRINDING MACHINES, Worm
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING WHEELS
Bakelite Co., Div. of Union Carbide & Carbon Corp., 30 E. 42nd St., N.Y., N.Y.
Besly-Welles Corp. (Abrasive Div.), 20 N. Wacker Drive, Chicago 6, Ill.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley St., Bridesburg, Philadelphia, Pa.
Sterling Grinding Wheel Co., Tiffin, Ohio

GROOVING TOOLS, Internal
Spiral Step Tool Co., Chicago 25, Ill.
Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

HAMMERS, Forging Air
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

HAMMERS, Pneumatic
Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

HAMMERS, Portable Electric
Thor Power Tool Co., Aurora, Illinois

HAMMERS, Power
Chambersburg Engrg. Co., Chambersburg, Pa.

HAMMERS, Shaft
Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft
Chambersburg Engrg. Co., Chambersburg, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HARDENING EQUIPMENT
General Electric Co., Schenectady, N. Y.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame
Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio
Gleason Works, 1000 University Ave., Rochester, N. Y.

HARDNESS TESTING INSTRUMENTS
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave., and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

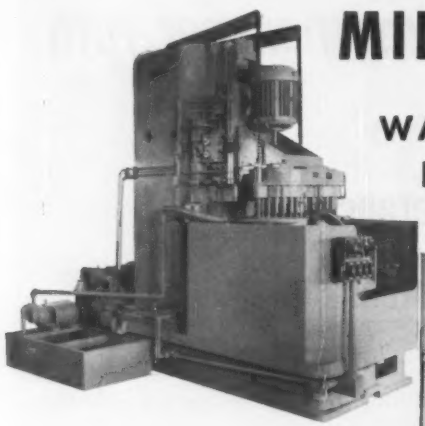
HEADERS, Cold
Behr Machinery & Equipment Corp., 1100 Seminary, Rockford, Ill.

HOBBING MACHINES
See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

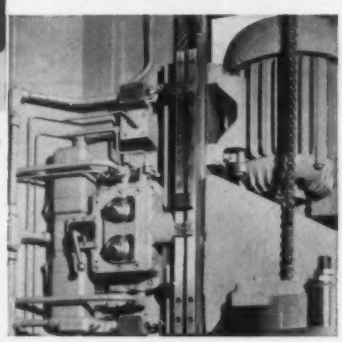
HOBS
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.

HOIST HOOKS
Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(Continued on page 330)



MILLHOLLAND
W-2000
WAY TYPE HYDRAULIC FEED UNIT



HORIZONTAL VERTICAL OR ANGULAR MOUNTING

SPECIFICATIONS

Stroke . . . . . 16"
Thrust at 1,000 P.S.I. . . 12,500 lbs.
Rapid advance . . . . . 230"/min.
Rapid return . . . . . 270"/min.
Coarse feed . . . . 0.6" minimum to 23.9" maximum per minute
Fine feed . . . . . 0.4" minimum to 8" maximum per minute
Table slide size . . . . . 16" x 32"
Weight . . . . . 1800 lbs.

Write for Bulletin M-9 giving complete specifications of this versatile unit.

Used as a standard component in Millholland-designed special machines, this unit will feed single and multiple-spindle drill heads, boring heads and milling heads. It provides a complete solenoid-controlled feed cycle consisting of rapid advance, two rates of feed which are independently adjustable, and rapid return. The cycle is automatic, but may be changed by adjusting dogs and feed rates. A manual lever is provided for the operator to control the slide for set-up purposes. A standard trouble-free Vickers centralized control panel is used, with coarse feed and fine feed control valves, plus the manual control lever.

The unit is sturdily constructed for long service with meehanite gibs.

The slide bearing surfaces are automatically lubricated at each reversal, and wipers are provided to keep ways clean.

Let Millholland Multiply Your Production

W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd. Indianapolis 20, Indiana

COMPLETE YOUR DATA FILES

S-200 REVIEW OF AIR GAGING

In "A Review of Pneumatic Dimensional Gages", Louis Polk, chairman and president of The Sheffield Corporation, describes the different types of air gages, their applications and uses. Amply illustrated with schematic drawings of pneumatic circuitry and photographs of multiple-dimension and automatic air gages. Contains selective bibliography on air gaging. 24 pages.

S-201 THEORY OF GAGING

Reprint from an address before the American Society of Mechanical Engineers, this six page technical paper reviews the operating principles of several types of mechanical, electrical, electronic and pneumatic gages. Many schematic drawings.

S-202 66 CENTURIES OF MEASUREMENT

Commemorative booklet issued at the time the permanent exhibit of precision measuring instruments was established at the Smithsonian Institution, Washington, D. C. Includes 16 colored drawings depicting significant periods and advancements in the history of measurement since 4700 B.C.

S-203 VISION IN METROLOGY

Printed from an address by Louis Polk, this pocket size booklet tells the story of measurement from the Cubit of the ancients to the "Baru" of the atomic age. In conclusion, the author presents some stimulating thoughts about the methods for dimensional control in the future.

S-204 ELI WHITNEY METROLOGY LABORATORY

This pocket-size booklet describes the construction, inspection environment, and instrumentation in Sheffield's newly opened laboratory for precision measurement. Lists the types of Measurement and Inspection services available to Industry including Gage Block and End Measure Calibration, Hardness Testing, and Surface Finish Analysis.

S-205 AUTOMATION CATALOG

Twelve page, easy-to-read catalog containing application and engineering data on standard Sheffield control units for automatic machine control, gaging, classifying, and segregating processes. Many photographs and diagrams of typical automated production processes.

S-206 THE SHEFFIELDER

A 4-page newspaper written for shop, production, and inspection personnel. Mailed free-of-charge 4 to 6 times a year. Contains feature articles and photographs on new gages and inspection instruments, better inspection practices, and news from Sheffield's Machine Tool Division.

S-207 GENERAL CATALOG

New 16-page, fully illustrated General Catalog of Sheffield Precision Products and Services. Included are Thread and Form Grinders, Annular Form Grinders, Crushtrue Grinding Machines, Threading Machines, Taps, Chasers, and Ultrasonic Machine Tools; also, Precisionaire inspection gages, Automatic and Multiple dimension gages, Toolroom and Inspection Instruments, and Contract Services.

S-208 NON-CONTACT X-RAY GAGE

A 16-page catalog describing the Sheffield "Measuray"—a non-contact X-Ray gage for continuous or intermittent measurement of strip or sheet stock while in motion or stationary—hot or cold. Contains models and capacity ranges as well as types of materials on which it can be used.

S-209 PRECISIONAIRE INSTRUMENTS

This 30-page catalog and price list on Precisionaire column-type air gages contains the full line of base instruments, with their amplifications and scales, and complete lists of standard sizes and types of air spindles, air snaps, Plunjet gaging cartridges, and types and sizes of adjustable air tooling.

S-210 PLUNJET GAGING CARTRIDGES

A 24-page catalog showing types, sizes, amplifications, tolerance and ranges of Sheffield Plunjet gaging cartridges. Contains engineering and technical data on the use of Plunjets to single and multiple dimension inspections and for machine control applications.

S-211 AIR GAGING JET ENGINE BLADES AND BUCKETS

The critical dimensions and conditions of jet engine blades or buckets and how they are gaged quickly and accurately with Sheffield Precisionaire gages are described in this 28-page catalog.

S-212 ADJUSTABLE AIR GAGE TOOLING

Engineering Data Sheets describing types and sizes of adjustable air gage tooling for use with Precisionaire instruments and other makes of air gages. Gages for measuring inside diameters include four adjustable spindles with ranges from ⅜" to 9/16", 9/16" to 1", ⅞" to 1 ½" and 1 ½" to 3"; also, the adjustable Airebore Gage Kit for any size bore from 3" to 12", and the 1" to 3" adjustable Balljet spindle kit. Standard 1" adjustable Plunjet Snap gages are available covering the range from 0" to 12".

S-213 AIRETEST INDICATOR

An 8-page Engineering Data Sheet covering the use of the Sheffield Airetest Indicator with the column type Precisionaire. It describes how this new style pneumatic pickup unit is used to accurately determine height, flatness, parallelism, and concentricity.

S-214 PLUNJET STEEL AND STONE FLATNESS GAGES

This Engineering Data Sheet shows how a Plunjet gaging cartridge applied to either a steel or stone surfaceplate makes an ideal combination for checking flatness to a high degree of accuracy.

S-215 PLUNJET EXTERNAL GRINDING GAGES

Engineering Data Sheet showing how a Plunjet gaging cartridge is used with Foster and Arnold Visual Grinding Gages to indicate stock removal evenly without oscillation or flicker normally associated with a dial indicator reading.

S-216 CRUSHTRUE WHEEL DRESSING PROCESS

What Crushtruing is and how it can be used is told in this 12-page catalog. Contains types and sizes of Crushtrue devices available for both surface and cylindrical grinders, and information on their selection. Many case histories and illustrations.

S-217 PRECISION THREAD AND FORM GRINDERS

Machine information and specifications catalog on Models 101, 103, 105, and 107 Precision Thread and Form Grinders. All models capable of plunge grinding.

S-218 MODEL 109 PRECISION ANNULAR FORM GRINDER

Use and specification information on this grinder which has a capacity of 12" between centers and will grind a maximum diameter of 4" with a 14" wheel, and will accommodate work up to 7" in diameter.

S-219 MODEL 180 CRUSHTRUE MULTI-FORM GRINDER

An 8-page catalog covering machine features and specifications of new model 180 Grinder. This machine uses a 4" wide Crushtrue dressed wheel and will grind work up to 10" in diameter and will accommodate a workpart 24" long. Features automatic grinding and gaging, automatic Crushtruing and automatic compensation for wheel wear after dressing.

S-220 MODEL 134 PRECISION THREAD AND FORM GRINDER

Both single and multi-pass models are described in this 8-page catalog. Model 134 is used to grind threads up to ½" diameter x 4" long within a pitch range from 20 to 120 T.P.I. Machine features include automatic grinding cycle, automatic wheel dressing, and automatic compensation.

S-221 MICRO-FORM GRINDERS

An 8-page catalog with inserts covering Sheffield's Micro-Form Grinders. These machines grind circular and flat form tools, templates, profile gages, cams, and Crushtrue rolls, etc., directly from a drawing of 50:1 ratio. Neither templates nor masters are required. Work is checked without removing from machine.

S-222 MODEL 140 GEAR GRINDER

An 8-page catalog containing machine and specification information on this reciprocating type gear grinding machine that is used to produce precision ground helical and spur gears from 8 to 50 inch. Crushtruing is used to from the grinding wheel to the basic rack form. Maximum work diameter is 8" and grinding stroke 4".

S-223 GEAR DEBURRING MACHINES

Machine features and specifications of seven models of gear deburring machines are described in this 8-page catalog. Both single and two station models are included.

S-224 GEAR AND SPLINE DEBURRING MACHINES

Six standard models and their specifications are included in this 8-page catalog. These machines are used for precision chamfering, tooth rounding or pointing of gears and splines. Gears up to 13" in diameter can be handled on standard machines—larger on special.

S-225 MACHINING THE UNMACHINABLE

A 16-page booklet describing the techniques, advantages, uses and machines for ultrasonic machining of hard materials such as carbides, glass, and ceramics.

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S-229 THREAD ROLLING ATTACHMENT — PRECISION-ROL

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S-230 VISUAL GAGES

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S-231 ELECTRONIC GAGE BLOCK COMPARATOR

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(Continued on page 332)

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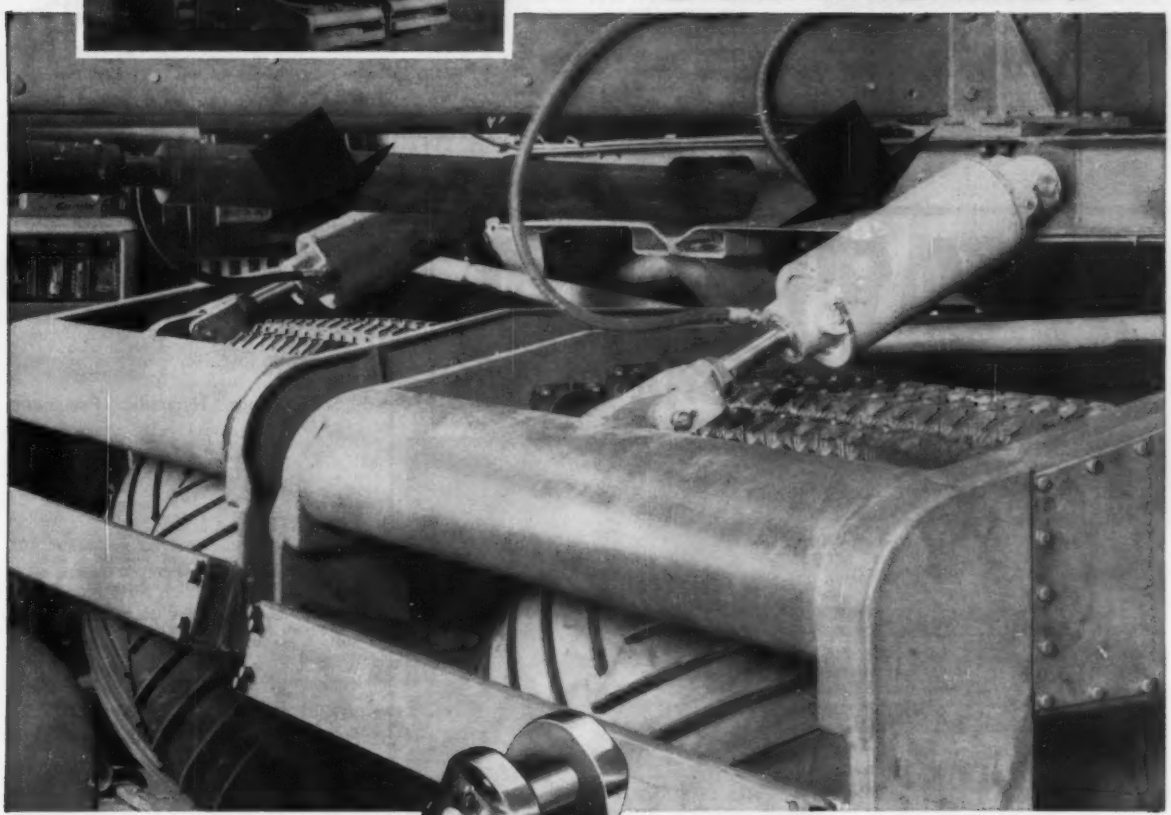

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(Continued on page 334)

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Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Hollow Spindle

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom

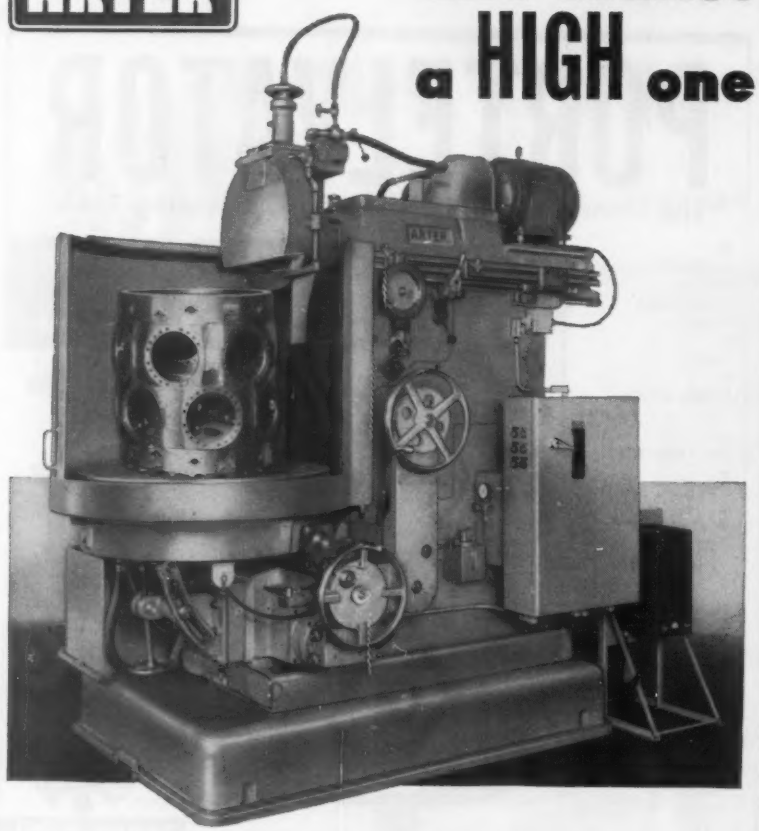
See Lathes, Engine and Toolroom

LATHES, Turret

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc. (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Morey Machinery Co., Inc., 383 Layfette St., New York 3, N. Y.
Potter & Johnston Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

ARTER

also makes a HIGH one



Vertical capacity of Arter Model B Hydraulic Rotary Surface Grinder can be increased 24" using a raising block. So, for grinding surfaces on such work as the crankshaft housing for the piston-type airplane engine, as shown, Arter has the answer. Arter has been building rotary surface grinders for nearly forty years. Model B is built in four sizes — 20", 24", 30" and 40" diameters.

Whatever your surface grinding needs, Arter can meet them.

ARTER GRINDING MACHINE COMPANY

WORCESTER 5, MASSACHUSETTS

Jigmatic Automatic Tape Controlled Positioning Table • Rotary Surface Grinders
Flat Circular Cutter Grinders • Internal Grinders • Cylindrical Grinders • Carbide Tool Grinders

AGENTS IN INDUSTRIAL CENTERS OF UNITED STATES AND CANADA

Springfield Mch. Tool Co., Springfield, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co. 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.

LAYOUT FLUID
Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS
Bullard Co., Brewster St., Bridgeport 2, Conn.
Starrett, The L. S., Co., Athol, Mass.

LIGHTS, Indicator
Dialight Corporation, 60 Stewart Ave., Brooklyn 37, N. Y.

LOCATORS, for Jig Borers
Arter Grinding Machine Co., 15 Sagamore Rd., Worcester 5, Mass.

LUBRICANTS, Including Extreme Pressure (EP) Machinery Lubricants
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Socony Mobil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS
Farval Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINISTS' SMALL TOOLS
See Calipers, Hammers, Wrenches, Drills, Taps, etc.

MAGNESIUM
Dow Chemical Co., Midland, Mich.

MAGNETIC BASES FOR INDICATORS
du Mont Corp., Greenfield, Mass.

MANDRELS
See Arbors and Mandrels

MARKING MACHINES AND DEVICES
Acromark Co., 9-11 Morrell St., Elizabeth 4, N. J.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.

MASKS, PAINTING
Conforming Matrix Corp., 342 Toledo Factories Bldg., Toledo 2, Ohio.

MATERIALS HANDLING TRUCKS
Automatic Transportation Co., 133 W. 87th St., Chicago 20, Ill.

MEASURING MACHINES AND INSTRUMENTS, Precision
Crane Packing Co., 6400 Oakton St., Morton Grove, Illinois
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S. Co., Athol, Mass.

METAL, Bearings
See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

METAL DISINTEGRATOR
Elox Corp., Royal Oak, Mich.

METERS
See Recording Instruments

MICROMETERS
Ames, B. C., Co. (Dial) Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

MICROSCOPES, Toolmakers
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING ATTACHMENTS
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., Milwaukee, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

(Continued on page 336)

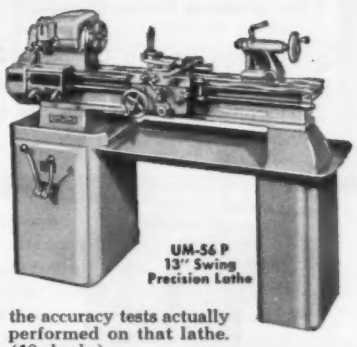
SHELDON Precision LATHES

for the size Lathes You Need Most

Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13". . . in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.

Powerful, all-V-belt, drive units—either the standard 8-speed (or 16-speed) E-drive; or the production favorite, a rapid, lever-shift U-drive. Where higher spindle speeds are desired, the standard E-drive can be built to provide speeds up to 2,000 r.p.m.

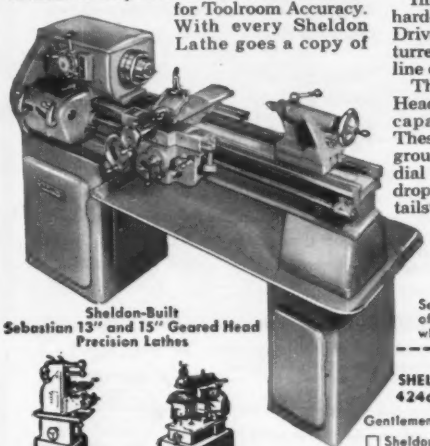
All Sheldon Lathes have handscraped, built-in precision. Each lathe is guaranteed to meet or surpass the American Standards for Toolroom Accuracy. With every Sheldon Lathe goes a copy of the accuracy tests actually performed on that lathe. (19 checks).



UM-56 P 13" Swing Precision Lathe

Important optional features include: hardened bed ways, L00 Long Taper Key Drive spindles, 4" D1 Camlock spindles, bed turrets, taper attachments and a complete line of toolroom and production accessories.

The new Sheldon-built Sebastian Geared Head Lathes have greatly increased work capacity and many advanced features. These include a wide, heavy, hardened and ground bed . . . easy shifting spindle speed dial . . . 60-pitch gear box . . . independent drop lever apron clutches . . . cam-action tailstock clamp . . . and, automatic lubrication in the headstock and apron with "1-shot" lubrication of carriage.



Sheldon-Built Sebastian 13" and 15" Geared Head Precision Lathes

SHELDON Horizontal Milling Machine

SHELDON 12" Shaper

SHELDON MACHINE CO., Inc.

Builders of Sheldon Lathes, Milling Machines, Shapers and Sebastian Lathes.

4246 North Knox Ave • Chicago 41, Ill.

Send in coupon or write for catalogs and names of nearest Sheldon and Sebastian Distributors where you can see these new lathes in operation.

SHELDON MACHINE CO., INC.
4246 North Knox Avenue, Chicago 41, Illinois

Gentlemen: Please send new catalogs describing:

☐ Sheldon ☐ 10", ☐ 11" ☐ 13" Lathes
☐ Sebastian 13" and 15" Geared Head Lathes
☐ Horizontal Milling Machine ☐ Name of Local Dealer
☐ Sheldon 12" Shaper ☐ Have representative Call:

Name ..... Title .....
Company Name .....
Street Address ..... ☐ Company ☐ Home
City ..... State .....

Why TECUMSEH Compressor Crankcases Are MICROHONED

"On Tecumseh compressors, we Microhone the piston bores. ***This gives us a running seal between pistons and bores which prevents gas leakage and eliminates the need for piston rings!*** Believe me, it takes a real combination of accuracy and functional surface finish to get results like that . . . and only Microhoning has given us that combination!"

(Tecumseh Products Company, Tecumseh, Michigan, is the world's largest producer of refrigeration compressors. Precision engineered and processed these units are hermetically sealed before leaving the factory.)

OTHER JOB DATA:

MATERIAL	Cast iron
PRECEDING OPERATION	Diamond finish-bore
MICROHONING OPERATIONS	One
STOCK REMOVAL	.0007" to .001"
FINISH	10 Microinches
TOLERANCES	
Diametric	.0003"
Roundness	.00015"
Straightness (Taper)	.00015"
HONING CYCLE	18 seconds, including fixture indexing time

"Here's our twin cylinder crankcase. The two piston bores in each case are opposite one another in the vertical plane, but they lie in two different horizontal planes. We simultaneously Microhone both bores in each crankcase, using a horizontal type machine with two opposing spindles."

"Although all of our crankcases are similar in design, the bores vary in diameter—1.312", 1.375", 1.500" and 1.625". Two fixtures on a two-position rotary indexing table let us Microhone one crankcase while another is being loaded. To run different bore diameters we just change the tools and gage rings. Switchover time is about five minutes."

Let a Micromatic Field Engineer show you how Microhoning will give you better functional finishes, closer tolerances and higher production.

☐ *Please have a Micromatic Field Engineer contact us.*

☐ *Please send literature and case histories on Microhoning.*

PRECISION PRODUCTION THROUGH MICROHONING — MICRO MATIC

NAME_____

TITLE_____

COMPANY_____

CITY_____ ZONE_____ STATE_____

MICROMATIC HONE CORP.

8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Springfield, Vt.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St.,
Kearney & Trecker Corp., Milwaukee, Wis.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney &Trecker Corp., Milwaukee, Wis.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain And Universal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., Milwaukee, Wis.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch., Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINE, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.

MILLING MACHINES, Profile

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Bridgeport Machine, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Burke Machine Tool Div., Cincinnati 27, Ohio.

MODEL AND EXPERIMENTAL WORK

See Special Machinery and Tools

MOLD AND DIE COPYING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.

MOLDING MACHINES, Plastic

Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

MOLYBDENUM

Climax Molybdenum Co., New York, N. Y.

MOTORS, Electric

General Electric Co., Schenectady, N. Y.
Howell Electric Motros Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

MOTORS, Hydraulic

Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NAMEPLATES

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

NIBBLING MACHINES

Wales-Strippet Co., North Tonawanda, New York

(Continued on page 338)

How MICROHONING Makes a Gas-Tight Running Seal Without Piston Rings

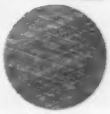
A leak-free, running seal between bores and pistons—without the use of rings—is possible only when the processing method generates diametric and geometric accuracy and the required functional surface finish. These characteristics are simultaneously obtained by the Microhoning process. Here's how:

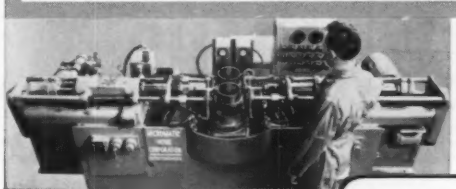
1 The sticks of abrasives in the tool form an abrasive "cylinder" and are fed out radially with equal pressure in all directions. High spots and tight areas in the bore are abraded first.

2 The long abrasive sticks cut only on the crests of wavy or snaky surfaces until the bore has the same diameter throughout its full length.

3 The combination of tool motion (rotation and reciprocation) and feed pressure fractures the abrasive grits that have become dull, and new sharp edges are formed; the clean constant cutting action of every stroke on the full bore length consistently generates the desired surface finish.

One of the exclusive advantages of Microhoning is its ability to produce whatever functional surface characteristics are required for maximum product performance. Microhoning's cross-hatch pattern, with its myriad of minute intersecting "valleys," furnishes an excellent surface for retention of lubrication.





"Here's one of two Micromatic Model 523-2 machines used on the compressor crankcase job. Tecumseh uses a total of 18 Microhoning machines on other vital processing operations."

The principles and applications of Microhoning are thoroughly explained in an informative 16mm., 30-minute sound movie, "Progress in Precision." We'll be glad to reserve a print for your use. Just tell us on the coupon the date you'd like to see it.

☐ Please send me "Progress in Precision" in time for showing on _____ (date)

☐ Please send literature on Microhoning. I am interested in the following application: _____

NAME _____

TITLE _____

COMPANY _____

CITY _____ ZONE _____ STATE _____

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

PERFORMANCE
Makes Gears
EASIER TO SELL

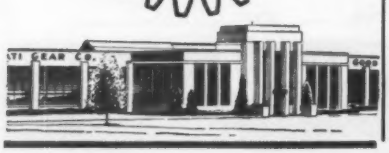
REPRESENTATIVE, THE CINCINNATI GEAR CO.

Often when calling on a new customer after his first gear order has been assembled and is in test operation, he will tell me something like "finest gears we ever used — certainly improved operating qualities of our product — no trouble in assembly, no vibration, they are as quiet as a precision watch". This customer is just learning what Cincinnati Gear's older customers already know, and what I've known for the thirteen years I've represented Cincinnati Gear in the Cleveland area: that we make *ONLY GOOD GEARS* — gears that give 100% performance at all times. If, by chance, there is an error, there is never a compromise; the gear is promptly replaced.

This pleases our customers, of course, but it also pleases me — and gives me the confidence in our firm and our product that I need to do a first-rate selling job. This confidence, I feel, is about the most valuable "sales aid" I have. I can solicit an order and know full well that the gears shipped will deliver performance desired — and result in the kind of customer satisfaction that leads to repeat orders. I can't think of anything that makes my job easier.

THE CINCINNATI GEAR CO.
CINCINNATI 27, OHIO
"Gears—Good Gears Only"

CINTI



NIPPLE THREADING MACHINERY
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

NUMBERING MACHINES
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

NUT SETTING EQUIPMENT
See Screw Driving and Nut Setting Equipment.

NUT TAPPERS
See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

NUTS, Thumb or Wing and Cap
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

OIL CUPS
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

OIL EXTRACTORS AND CLEANERS
De Laval Separator Co., Poughkeepsie, N. Y.

OIL HOLE COVERS
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

OIL GROOVERS
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OIL SEALS
Crane Packing Co., 6400 Oakton St., Morton Grove, Illinois
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois
Madison-Kipp Corp., Madison, Wis.

OILS, Cutting
See Cutting and Grinding Fluids.

OILS, Lubricating
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York.
Socony Mobil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago, Ill.

OILS, Soluble
See Compounds, Cutting, Grinding, Metal Drawing, Etc.

OPTICAL FLATS
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

ORDNANCE MACHINES, Special
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
Milholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PACKING, Leather, Metal, Rubber Asbestos, Etc.
Crane Packing Co., 6400 Oakton St., Morton Grove, Illinois
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.

PAINT, Corrosion Resistant
Copon Associates, P.O. Box 1113, Houston 1, Texas

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

PIPE, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Orban, Kurt, & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

PLANER ATTACHMENTS
Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLANERS, Double Housing and Openside
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A. Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLATE ROLLS
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.

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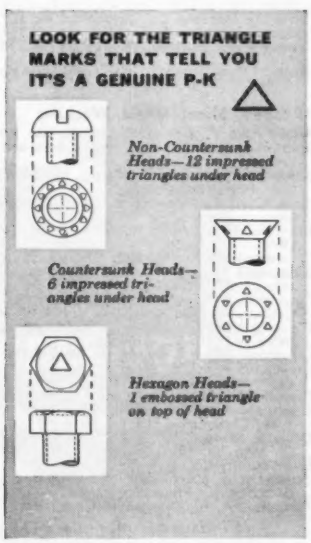
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Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

PLATES, Surface

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

PNEUMATIC EQUIPMENT

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.

POLISHING LATHES AND MACHINES

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POLISHING TOOLS, Portable

Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Illinois

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads

PRESSES, Arbor

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
duMont Corp., Greenfield, Mass.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Threadwell Tap & Die Co., Greenfield, Mass.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.

PRESSES, Extrusion

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Press Co., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PRESSES, Foot

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
Anderson Bros., Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Detroit Broach Co., (special & Semi-special) P. O. Box 156, Rochester, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Mch. & Welder Co., Warren, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines,
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

Allen, Alva F., Box 426, Clinton, Mo. (Bench)
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 50, Ill.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.

(Continued on page 341)

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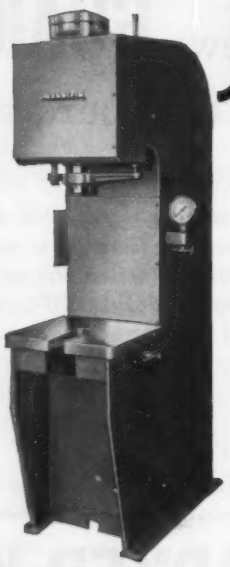

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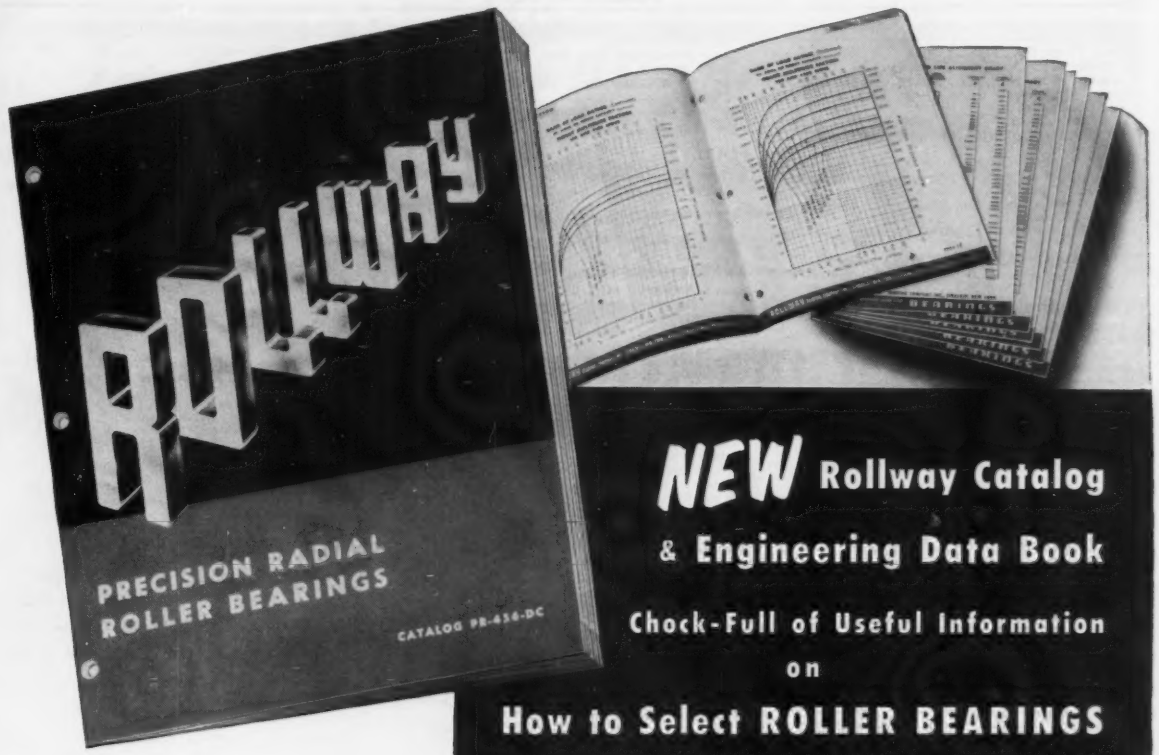

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Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Johnson Machine & Press Corp., Elkhart, Ind. Pittsburgh, Pa.
L & J Press Corp., Elkhart, Ind.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Co., North Tonawanda, New York
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Straightening

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Niagara Machine & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PROFILING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George Machine Co., 1110 W. 13th St., Racine, Wis.
Morey Machinery Co., Inc., 383 Layfette St., New York 3, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I.

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gray-Mills Co., 1948-52 Ridge Ave., Evanston, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incroporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

PUMPS, Rotary

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

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PUNCHES, Centering

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Allen, Alva F., Box 426, Clinton Mo.
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Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
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Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Joseph T. & Son Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Co., North Tonawanda, New York
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

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REAMERS

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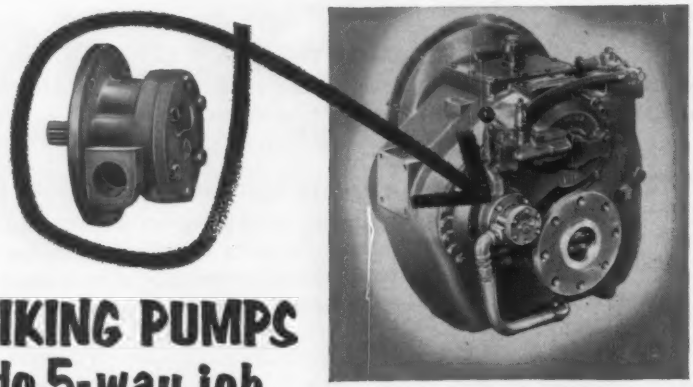
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.

(Continued on page 344)



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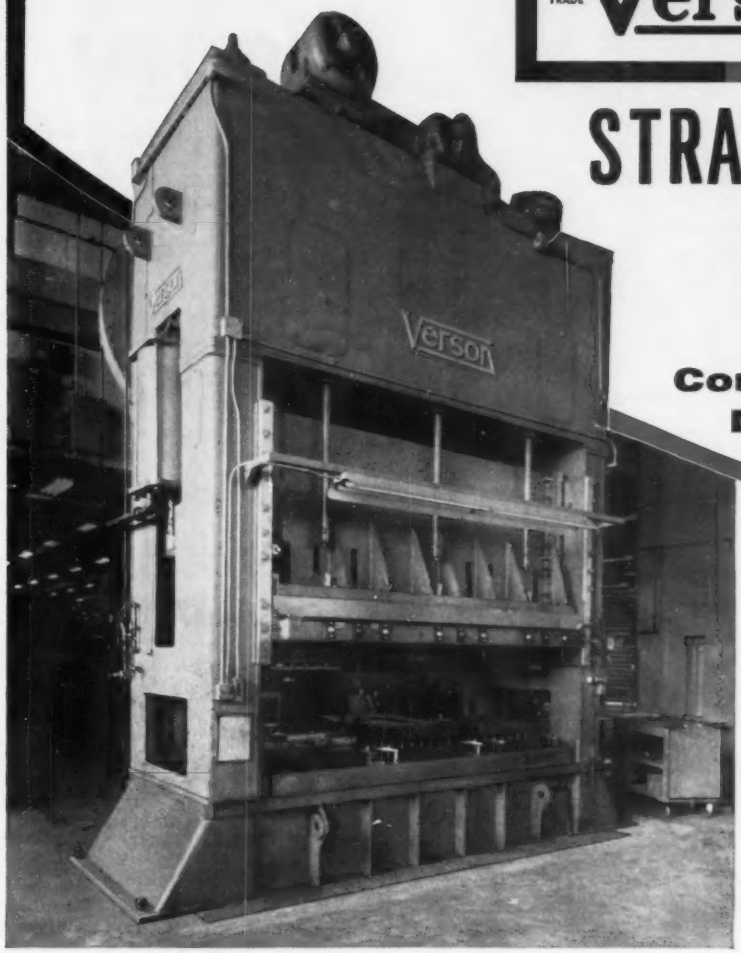

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- Will not powder under the most severe service.

Special formulas, developed for specific or unusual conditions, assure the best combination of physical properties.

Superior Service Guaranteed

OR YOUR MONEY BACK!

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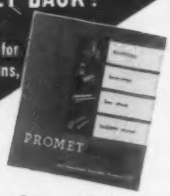

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Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
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Ingersoll-Rand Co., Phillipsburg, N. J.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Illinois
Wood & Co., R. D. Public Ledger Bldg., Philadelphia, Pa.

RIVETING MACHINES

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
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(Continued on page 346)

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QUALI-MATIC MACHINES

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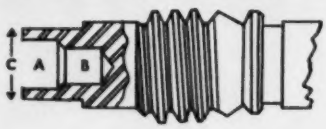
Finish, for a top automotive manufacturer, a speedometer magnet shaft by drilling and countersinking 2 diameters (A&B) maintaining concentricity with the main diameter (C) within plus or minus .002 total indicator reading with no damage to ground finish.

SOLUTION



Townsend of Hartford. A Townsend High Speed Shaving Machine, with motorized drill attachment, produced 1200 pieces per hour—per machine. Exclusive automatic hopper feed permits one man to operate 4 to 6 machines.

RESULT

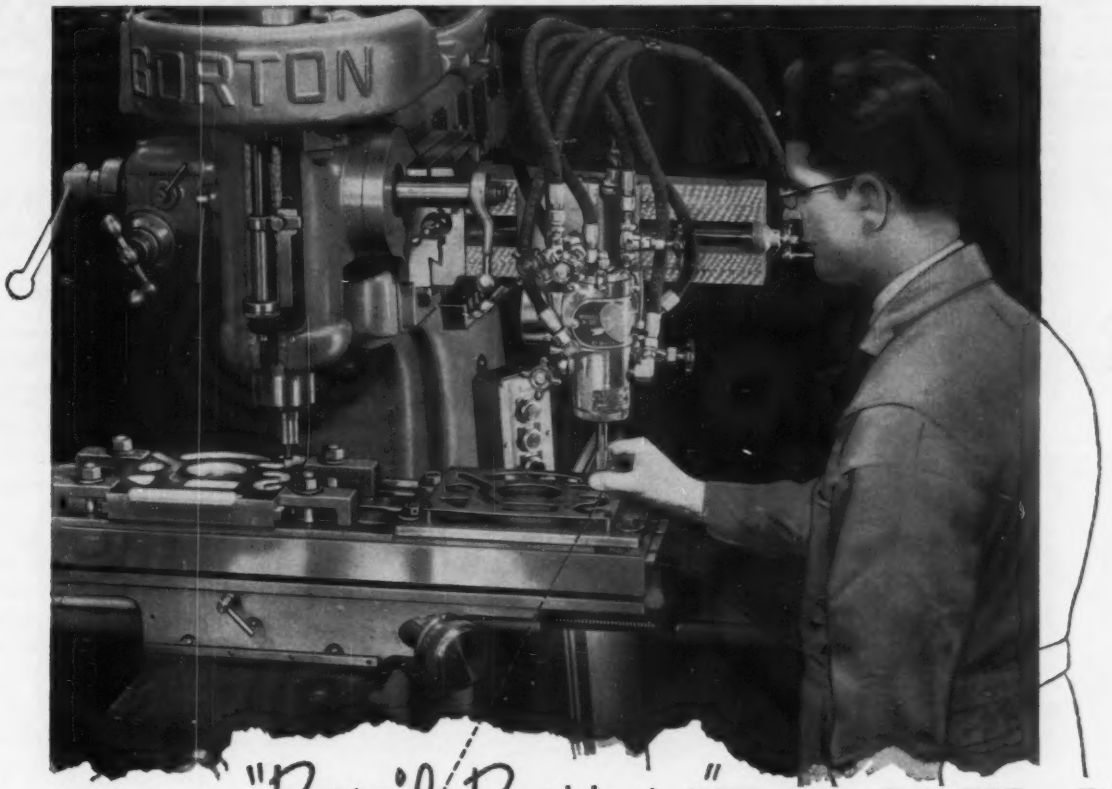
Townsend machines operated by one man—can accurately mass produce from 38 to 51 thousand pieces in one eight hour working day.

NOTE:

This same machine can be easily retooled for a drilling, turning, or facing operation within range of 1/4 to 3 inches, from .080 to .625 diameter.

The H. P. TOWNSEND MANUFACTURING CO.
ELMWOOD, CONNECTICUT

Now... Gorton Milling Machines Feature Hydraulic 3-Dimensional Controls



"Pencil Pressure" Does the Work

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Gorton also offers manual and automatic Tracer-Controlled Milling Machines and Pantographs for 2- or 3-dimensional operation; 1 to 1 ratio, or reproduction at variable reductions, with single or multiple-spindle machines for work of any shape or size.

Shown above: Gorton 9-J Super-Speed Vertical Mill with True-Trace hydraulic installation.

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Mattison Machine Works, Rockford, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
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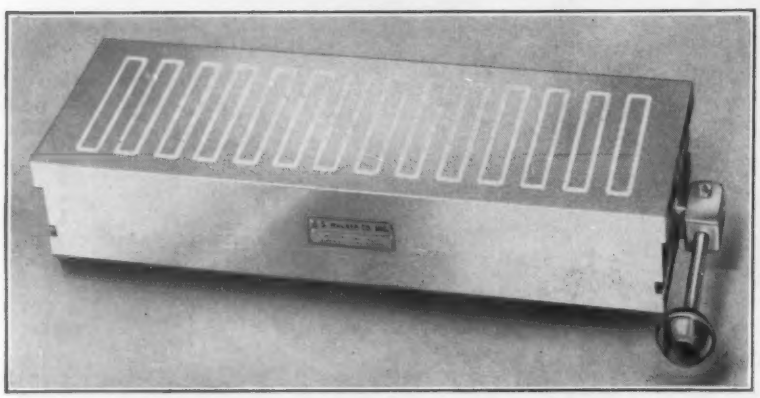
SAW SHARPENING MACHINES
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.

Walker Chucks
You May As Well Have the Best



Pioneer in the making of magnetic chucks, Walker engineers have the know-how to produce chucks that have the proud distinction of being the best in the world.

Walker Permanent Rectangular Chucks are made in nine standard sizes from 4" x 8" to 12" x 24" and larger for special applications.

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Simonas Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids, Michigan
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DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
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Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
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National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
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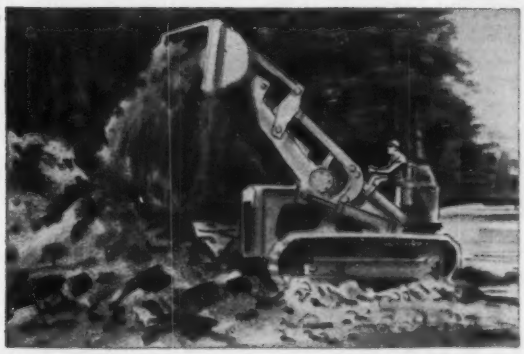
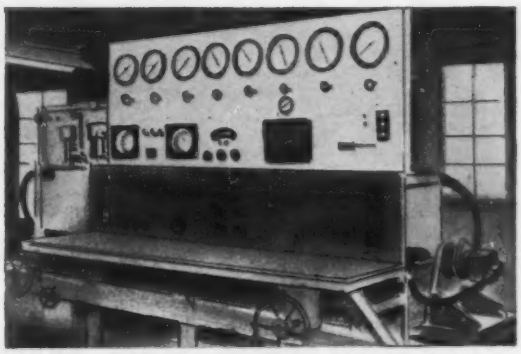
(Continued on page 348)

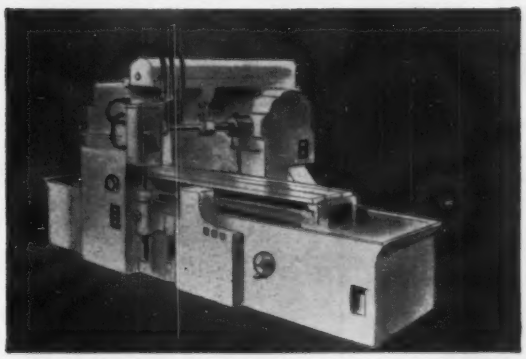
How hydraulic systems are simplified with 2000 psi vane pumps



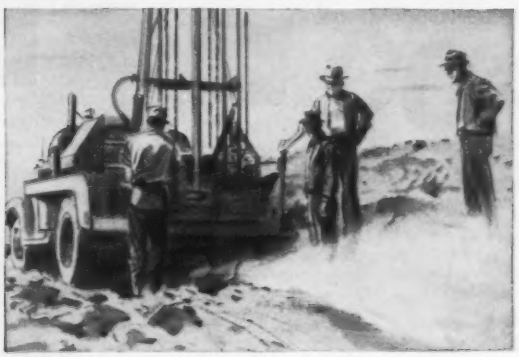
Lower weight on mobile equipment with smaller size lines, smaller controls.



Lower cost for test stands which require pressures up to 2000 psi.



Less space to pack more power with smaller size cylinders and valves on hydraulic machines.



Higher torque, higher horsepower per GPM – continuously on drilling equipment.

Exclusive balanced vane cuts wear, increases volumetric efficiency, reduces pulsations.

Vane-Type DENISON hydraulic, single stage pump/motor

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As a pump, this Denison unit has high volume output at 2000 psi continuous delivery. As a motor, it delivers a high stalled torque . . . up to 257 inch-pounds per 1000 psi.

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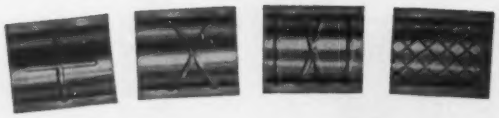
CONTINUOUS OIL GROOVING



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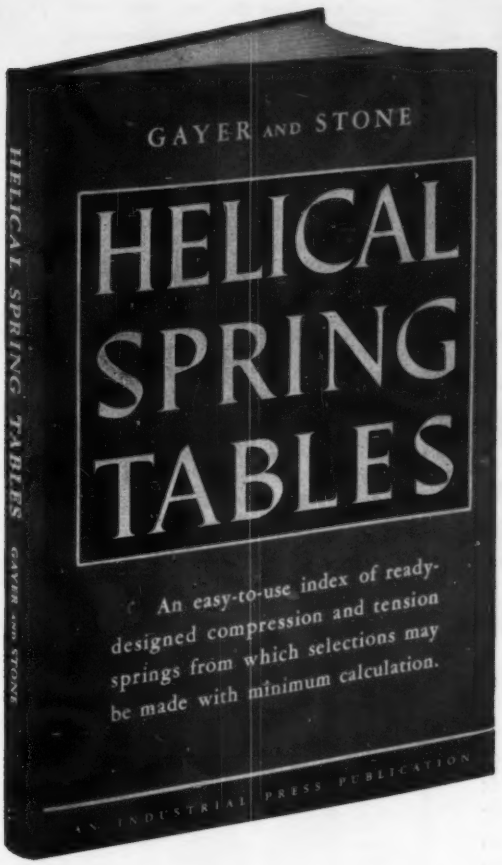
(Continued on page 350)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Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SHAPERS, Vertical
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPERS, Structural
Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

SHEARS, Rotary
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.

SHEARS, Squaring
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co., (Blades), 470 Main St., Fitchburg, Mass.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

SHEET METALS
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
New Jersey Zinc Co., 160 Front St., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEETS, Iron and Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div. Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

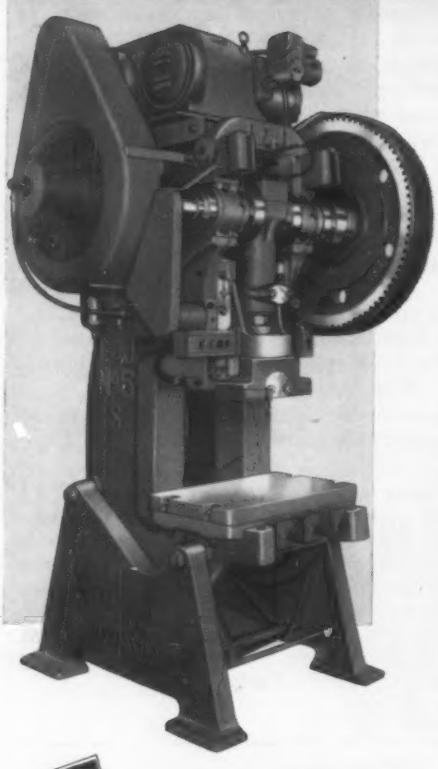
SHIMS
Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Shenango-Penn Mold Co., Dover, Ohio.

SLOTTING MACHINES
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.

(Continued on page 352)

New L&J No. 5 PRESS
Keeps Production Efficient



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Air clutch on back shaft, variable speed drive and flanged ram optional at extra cost. Non-geared type also available.

WRITE FOR CATALOG describing all L & J O.B.I. Presses — 20 geared and non-geared models. Capacities 14 to 90 tons. Also, 20 to 50 ton High Speed Straight Side Presses.

Specifications
Capacity—56 tons. Standard stroke—4". Maximum stroke (to order)—6". Strokes per minute—46 (non-geared 95). Die space—11¼" to 18¼", stroke down, adj. up.

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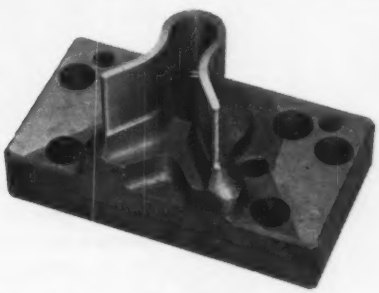
HOLES from 1/64" to 8" Relocated and Ground within .0001" in One-Third Previous Time

Before hardening, this two-station die block was Moore-Jig-Bored to eliminate the need for excessive grinding. After hardening and surface grinding, all holes were Moore-Jig-Ground to exact size and location. Blank hole and center piercing hole were ground with ½° included taper. Little clearance could be allowed between punch and die. Jig grinding time: *only 2¾ hours.*



CONTOURS, Too, Accurately Jig Ground and Checked in One Setting

This flanged punch, impractical to grind by any other method, was a natural for the No. 2 Moore Jig Grinder. All radii—male and female—were ground accurately to location and size. The piece, having been set up on a rotary table, was aligned to permit grinding of the angular surfaces. And the entire contour was inspected by the "indicator measuring" method while the punch was still on the machine.

The word "versatile" must have been coined for the No. 2 Moore Jig Grinder. Not only does this machine relocate and grind straight and tapered holes with ease, but it contour grinds, chop grinds and slot grinds just as skillfully.

The Moore Jig Grinder, together with its toolroom teammate, the Moore Jig Borer, enables tool and die sections to be produced concurrently, puts diemaking on an interchangeable-parts-and-assembly basis. And it's also a time-saver on production jobs.

Employing the accurate lead screw measuring principle and a convenient system of coordinate hole location, the fast and sure Moore Jig Grinder eliminates hours of checking on bench and surface plate.

Why not find out how this remarkable machine can save *you* sizeable chunks of time and money. Write today for our detailed bulletin.

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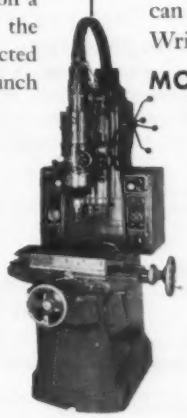

NO. 2 MOORE JIG GRINDER
Range 10" x 16" x 16" height. Grinding speeds from 12,000 to 60,000 rpm. Infinite feeds up and down; spindle-housing heat control. Features slot grinding attachment.

For more information fill in page number on Inquiry Card, on page 231

Consolidated Mch. Tool Corp., Rochester, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Townsend, H. P., Mfg. Co., Elmwood, Conn.

SOCKETS

Armstrong Bros., Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
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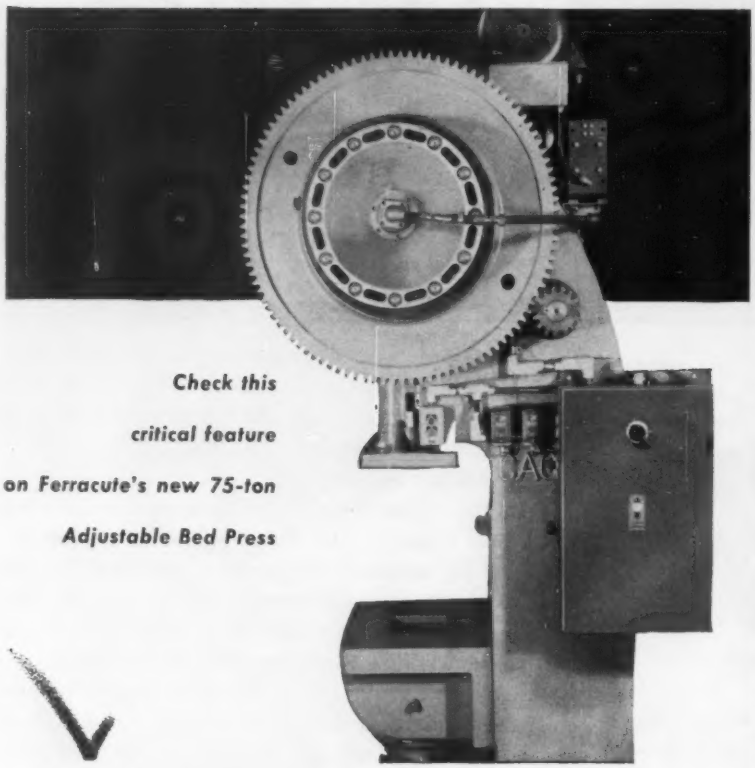
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.



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AIR OPERATED FRICTION CLUTCH

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Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
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Consolidated Mch. Tool Corp., Rochester, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
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Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
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Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
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Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros., & Co., 12th and Columbia Aves, Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydraulic Press Mfg., Co., Mount Gilead, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
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Mercury Engrg. Corp., Milwaukee, Wis.
Michigan Drill Head Co., Detroit 34, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
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Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaro Machine Corp., Wayne Junction, Philadelphia, Pa.
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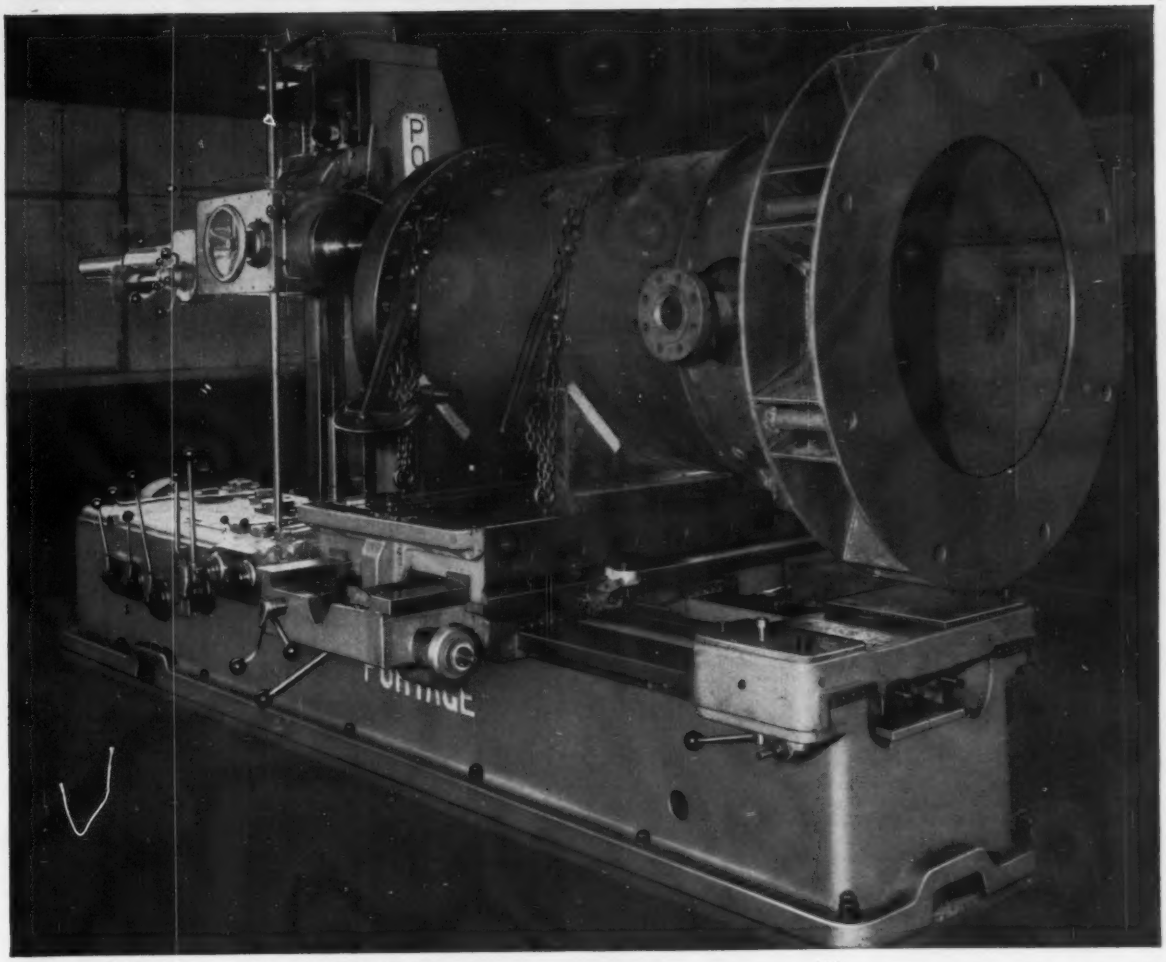
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co. Inc., 25 Main St., Ansonia Conn.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Philadelphia Gear Works, Inc., Erie Ave. and G. St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

SPINDLES, Boring and Milling

Pope Mchry. Corp., Haverhill, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

(Continued on page 354)



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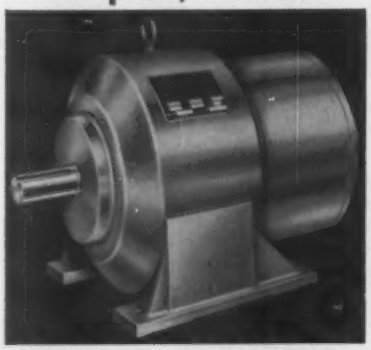

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Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
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Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

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Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

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American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
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Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co.), Div., 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

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Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
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Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

(Continued on page 356)

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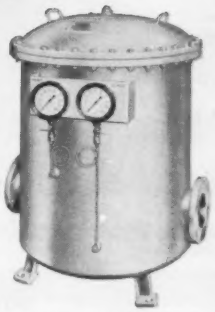

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Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh Pa.

STEEL, Tool and Die

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS

See Alloys, Steel

STEEL BARS

See Bars, Steel

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Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

STELLITE

Haynes Stellite Div., Union Carbide & Carbon Corp., (Alloy), 30 E. 42nd St., New York, N. Y.

STOCKS, Die

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., Greenfield, Mass.

STONES, Oil or Sharpening

Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS

Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES

Starrett, The L. S. Co., Athol, Mass.

STRAIGHTENERS, Flat Stock and Wire

Lewis Machine Co., 3441 E. 76th St., Cleveland 27, Ohio
Sesco, Inc., 8881 Central, Detroit 4, Mich.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

STUD SETTERS

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.

SUB-PRESSES

Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES

See Plates, Surface

SWAGING MACHINES

Behr Machinery & Equipment Corp., 1100 Seminary, Rockford, Ill.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.

SWITCHES

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

TACHOMETERS

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

TAPER PINS, Standard

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.

TAP HOLDERS

Burg Tool Mfg. Co., Inc., 15001 S. Figueroa St., Gardena, Calif.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

TAPPING ATTACHMENTS AND DEVICES

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Snow Manufacturing Co., Bellwood, Illinois
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 70, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

TAPPING MACHINES, Nut

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
Snow Manufacturing Co., Bellwood, Illinois

TAPS

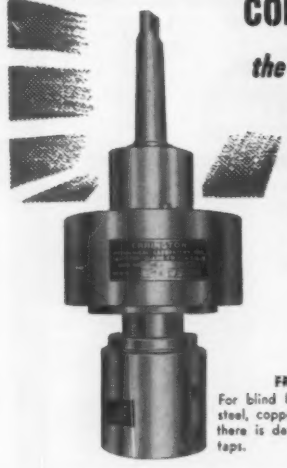
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Continental Tool Works, Div. Ex-Cell-O Corp., Detroit 32, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.

(Continued on page 358)

ERRINGTON TAPPERS . . .

the COMPLETE LINE . . .

the LEADING LINE SINCE 1891



Errington specializes in the manufacture of high speed multiple drilling and tapping attachments. The name Errington is your assurance of top-quality products . . . your assurance of the finest and most modern tools to produce first-grade workmanship at minimum operating costs.

QUICK-CHANGE
Tool-Holders to Drill, Tap and Set Studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustment in each tap-holder, if required.

POSITIVE
For through holes where work is drilled and then re-handled and tapped.

BALL BEARING CONE-DRIVE
Designed for Ball Bearing High Speed Drill Press.

FRICTION
For blind holes, tapping in steel, copper, etc. wherever there is danger of breaking taps.

These Tappers may also be adapted for button or acorn die threading.

Write for Complete Information

ERRINGTON Mechanical Laboratory, Inc.

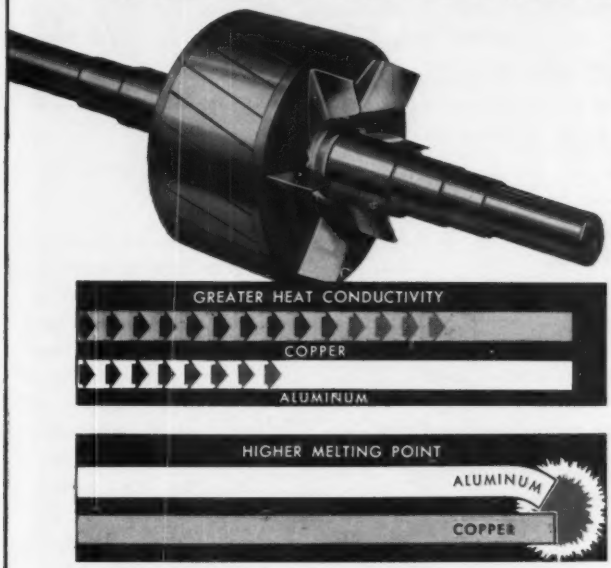
Established 1891

Main Office and Plant STATEN ISLAND 4, NEW YORK

HEAT DISSIPATING COPPER-CLAD ROTORS

PLUS values in power

in HOWELL series one hundred motors give you



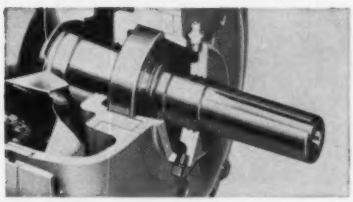
COOL-RUNNING EFFICIENCY, GREATER ABILITY TO WITHSTAND ABUSE

The copper bar rotors of Howell Series 100 motors mark a basic difference between these and motors with cast aluminum rotors. Copper's greater heat conductivity insures that internal motor heat is dissipated faster . . . before it can deteriorate vital insulation and shorten motor life. The diagram at left shows why . . . copper's heat conductivity is 91% greater than aluminum's.

What's more, copper's higher melting point . . . 1083° F. against 660° F. for aluminum . . . plus the inherent uniformity and greater strength of Howell's copper-clad rotors, means substantially more stability under overload conditions.

There's a world of difference in motors. Compare . . . and you'll specify Howell Series 100.

GET THE PLUS values THAT COUNT....specify HOWELL series 100 motors

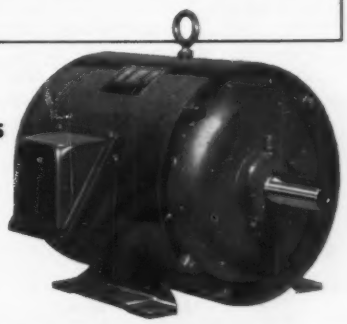


bearing protection doubled for longer motor life

On Series 100 TEFC motors, bearing cartridges defy dust and dirt, even when the motor is disassembled for servicing. You can't buy better assurance of motor dependability.

steel feet and frames won't crack under stress

Unlike cast iron, steel feet won't crack when mounting bolts are tightened too much . . . and Howell's steel frames take more installation punishment.



smaller, lighter, better looking

Save machine and storage space, save shipping weight, and get new functional streamlining that matches the motor to your most modern machine design or production equipment. Why put up with dust catching fins on a motor, when sleek good appearance costs no more.

For more details on Series 100 motors, write for Bulletin N-100-R

PRECISION-BUILT MOTORS FOR INDUSTRY SINCE 1915

HOWELL Red Band MOTORS

HOWELL MOTORS

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

For more information fill in page number on Inquiry Card, on page 231

finish SQUARE HOLES in ONE PASS...

with

Minute Man® SQUARE BROACHES

You can finish an *accurate* square hole in a drilled, reamed or cast bore in *one pass* in *less than one minute* with a Minute Man Square Broach.

Used in a hand-operated or hydraulic press, these High Speed Push Type broaches are ideal for putting square holes in boring bars, for jig, fixture and die work and for square coupling work.

They are available *from stock* in eight standard sizes from 3/16" square to 3/4" square.

The square holes in this tool bit holder were first drilled and tapped then finished with standard Minute Man Square Broaches at a considerable saving in time and money over previous methods.

The duMONT CORPORATION
Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST M describing Square Broaches, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....

Company.....

Address.....

Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing

Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

THREAD CUTTING MACHINERY

Brown & Sharpe Mfg. Co., Providence, R. I.
Casa Corp., 405 Lexington Ave., New York 17, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Lees-Bradner Co., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Snow Manufacturing Co., Bellwood, Illinois

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

THREAD GAGES

See Gages, Thread

THREAD GRINDING MACHINES

See Grinding Machines, Thread

THREAD MILLING MACHINES

Coulter, James, Machine Co., Bridgeport 5, Conn.
Lees-Bradner Co., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Waltham Machine Works, Newton St., Waltham, Mass.

THREAD ROLLING HEADS

National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

THREAD ROLLING MACHINES

Landis Machine Co., Waynesboro, Pa.
Hartford Special Mchry. Co., 287 Homestead St. Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.

TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R.R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL BITS, Special Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1200 Woodward Heights Blvd., Ferndale, Mich.

TOOL CONTROLS

Royal Design & Manufacturing, Inc., 4133 E. Ten Mile Rd., Centerline, Mich.

TOOL GRINDERS

See Grinding Machines for Sharpening, Turning and planing Tools

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Burg Tool Mfg. Co., Inc., 15001 S. Figueroa St., Gardena, Calif.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Portage Double Quick Tool Co., 1063 Switzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol, St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOLMAKERS' INSTRUMENTS

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped

Ace Drill Corp., Adrian, Michigan.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Spiral Step Tool Co., Chicago 25, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

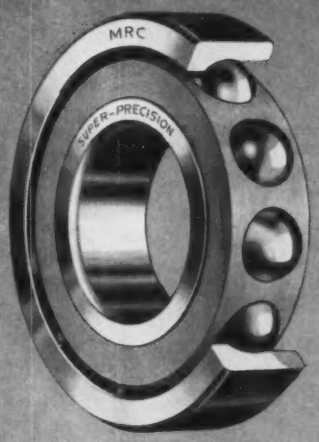
TOOLS, Lathe, Shaper and Planer

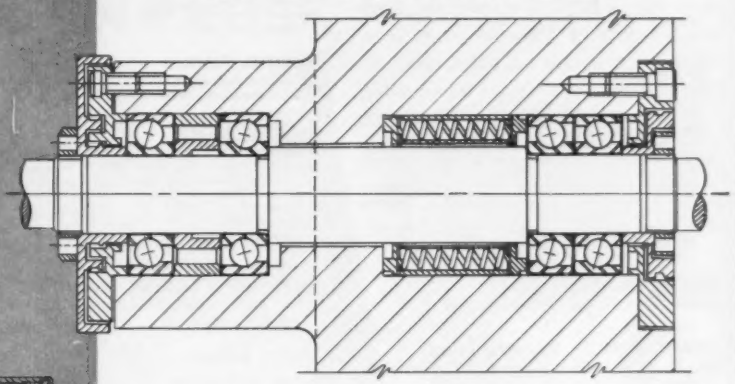
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

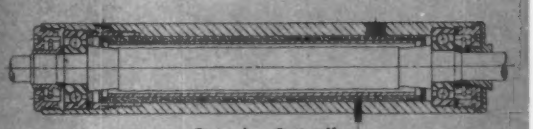
(Continued on page 360)

Long life accuracy

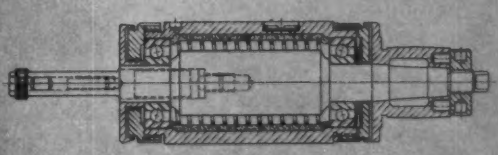
IN MACHINE TOOL SPINDLES with M-R-C SUPER-PRECISION BALL BEARINGS



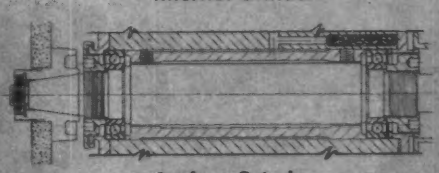




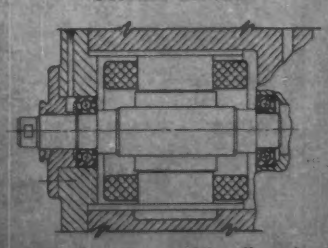
Grinder Spindle



Internal Grinder



Surface Grinder



Hi-Frequency Wheelhead

M-R-C Ball Bearings are used today in many leading machine tool spindles operating successfully at 100,000 RPM and over.

The illustration above is an example of a successful application of M-R-C SUPER-PRECISION bearings. This grinder spindle requires the highest degree of accuracy and long life obtainable only with M-R-C SUPER-PRECISION.

Still higher standards have been made possible by the facilities of our new SUPER-PRECISION plant devoted exclusively to this type bearing.

There is a M-R-C Ball Bearing for every machine tool application requiring accuracy and long life.

Consult OUR Engineering Department on YOUR bearing problems

MRC
BALL AND ROLLER *bearings*

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Bullard Co., Brewster St., Bridgeport 2, Conn.
du Mont Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TRANSFER MACHINES, Automatic
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TRANSFORMERS
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TRANSMISSION, Variable Speed
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.

Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TUBE FORMING AND WELDING MACHINES
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

TUBE MILLS
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

TUBING, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 34, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

TUBING, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
National Tube Div., U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.

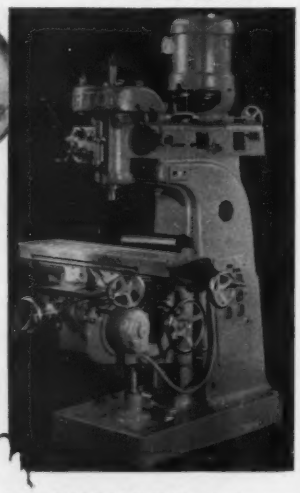
TURNING & BORING MACHINES
Hoern & Dilts Div., New Britain Machine Co., Saginaw, Mich.

TWIST DRILLS
See Drills, Twist

SAVE TIME and MONEY

with **Ruthman GUSHER coolant pumps**

This milling machine, manufactured by George Gorton Machine Company, is equipped with a Ruthman Gusher Coolant Pump in back of the column.



Operating and maintenance costs are reduced when you specify Gusher Coolant Pumps. You get split-second coolant flow . . . controllable as to volume. There is no priming or packing needed. Heavy-duty pre-lubricated ball bearings and electronically-balanced rotating shaft give you long life with minimum cost of maintenance. We will be glad to advise you on your coolant problems.

Model 5-P 3

THE **RUTHMAN** MACHINERY CO.
1807 Reading Rd. Cincinnati, Ohio

UNIVERSAL JOINTS
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.

VALVE CONTROLS
Philadelphia Gear Works, (Motorized), Erie Ave. and G St., Philadelphia, Pa.
Versa Products Co., Inc., 249 Scholes St., Brooklyn 6, N. Y.

VALVES, Air
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

VALVES, Hydraulic
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines Ill.
Hunt, C. B., & Son, 1911 E. Pershing St., Salem, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Versa Products Co., Inc., 249 Scholes St., Brooklyn 6, N. Y.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

VALVES, Pneumatic
Versa Products Co., Inc., 249 Scholes St., Brooklyn 6, N. Y.

VIBRATION INSULATION
American Felt Co., Glenville, Conn.

VISES, Machine
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago Tool & Eng. Co., 8389 So. Chicago Ave., Chicago, Illinois
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engineering Co., Frankenmuth 2, Mich.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

VISES, Pipe
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

VISES, Planer and Shaper
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Elum and Garrard Ave., Cincinnati, Ohio.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
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(Continued on page 362)

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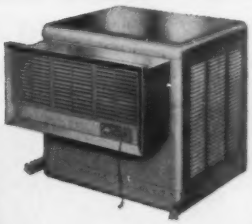

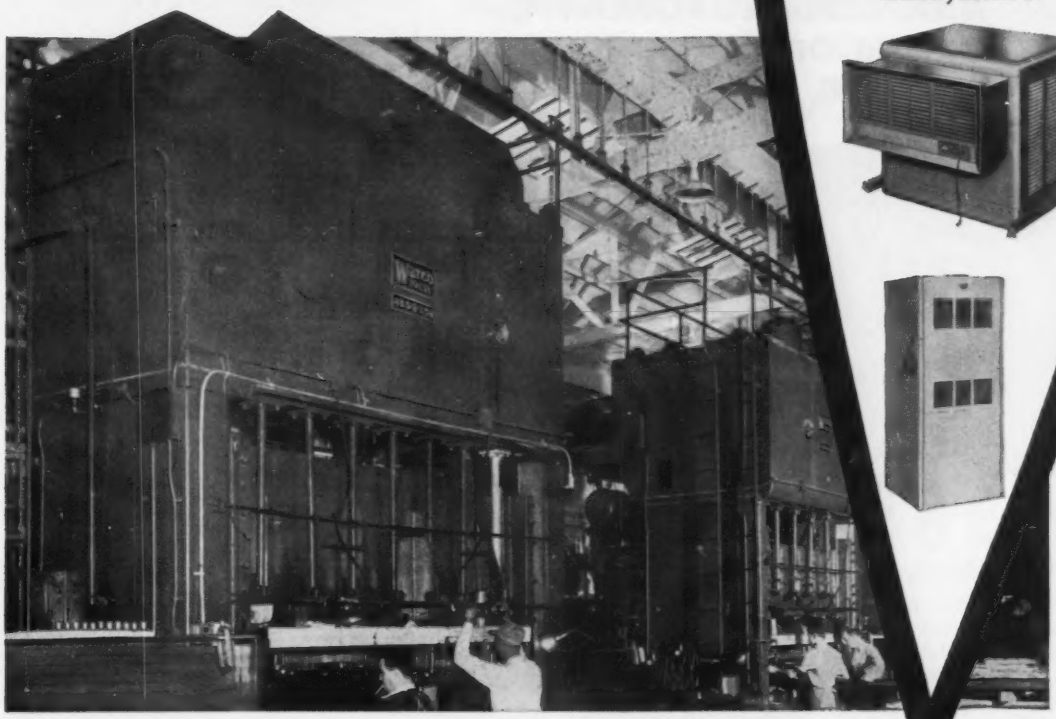

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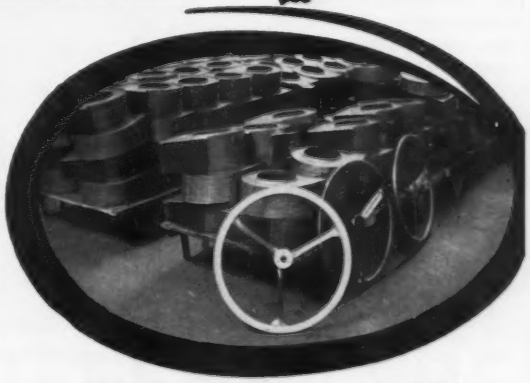

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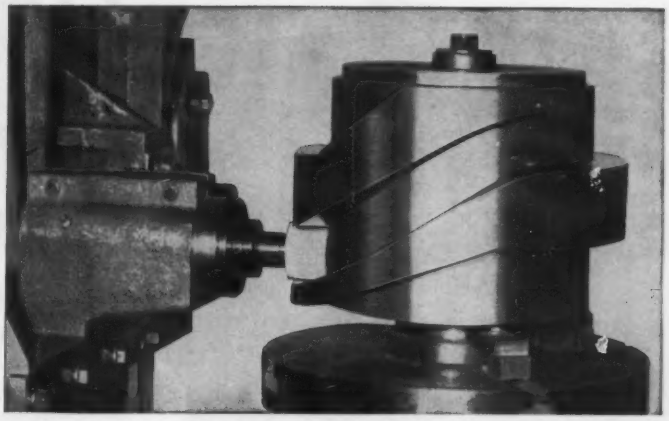

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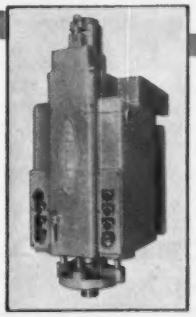

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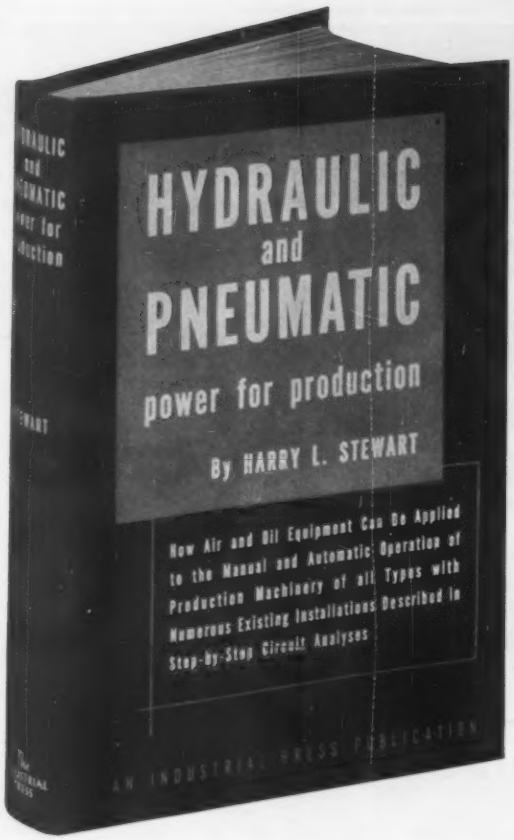
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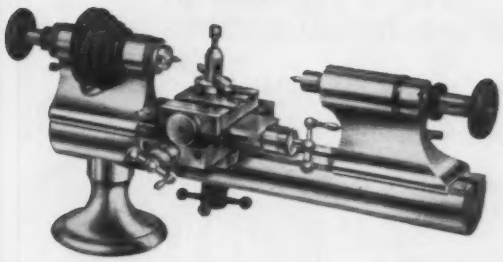

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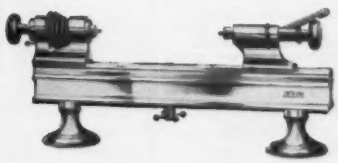

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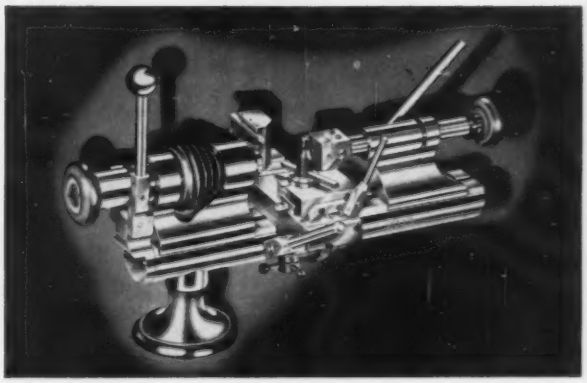

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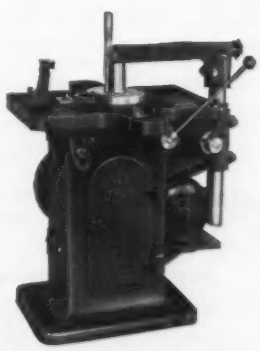

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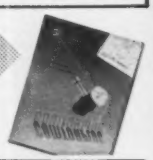

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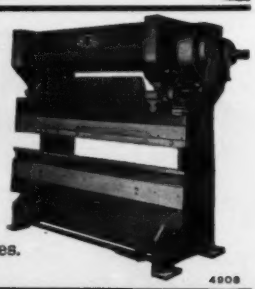

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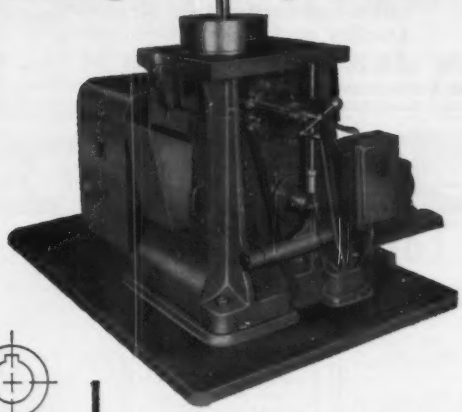

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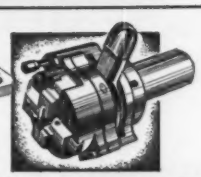

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Model B—1-1/16" Cleveland, m.d.
4 spindle 1⅝" Cleveland Model M, m.d.
4 spindle 2" Model K Cleveland, m.d.
2" Cleveland Model A, single spindle, m.d.
2½" Cleveland, m.d., Model A
No. 8A Cleveland, m.d., 8" cap., latest
14" Fay Flanders Type, m.d.
No. 4D Potter & Johnston, m.d.
No. 6C Potter & Johnston, m.d.
No. 5 D&LX Potter & Johnston, m.d., late

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Victor Nut Facing Machine, m.d., cap. ⅜" to 2" nuts
1¼" Landis 2 spindle, older type
1½" Landis Stay Bolt Threading Machine, Double Head, m.d.
No. 326 Outer Bolt & Pipe Threading Machine, m.d.

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4" bar Lucas, m.d.
5⅛" bar Betts Floor Type, m.d.
5⅛" bar Niles-Bement-Pond, m.d.
8" bar Barrett No. 6 Horizontal Cylinder, m.d.
10" bar Sellers Floor Type, m.d.
No. 25T Giddings & Lewis, m.d., late
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16" Bullard Mult-Au-Matic, m. d.
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36" Bullard H.S. Spiral Drive, 1942
42" Bullard New Era, m.d.
42" King, direct m.d., thru gear box
42" King with side head and plain swivel head on rail, 1940
44" Putnam, m.d., p.r.t.
48" Niles-Bement-Pond Car Wheel Borer, m.d.
53" Niles Heavy Pattern, m.d., p.r.t.
100" Niles Heavy, m.d., p.r.t.
102" Niles Wheel Turning Boring Mill

BROACHING MACHINES
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12x72" Thompson Automatic Flat Broach, m.d.
10 ton, 84" stroke LaPointe Single Ram Vertical Surface Broach, m.d., late
Type SBD-42-6 American Vertical Hy. Dup. Broach
Type SBD-48-15 American Vertical Dup. Ram Surface Hydr. Broach
No. 3 Oilgear Hydraulic Broach, type XA, 54" stroke, m.d.

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Baush. Radial Drilling & Tapping Machine, m.d.

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No. 15 Buffalo Floor Model, m.d.
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1 spindle No. 2MA6 Avey High Speed, m.d., 7½" overhang, 1943
2 spindle Allen, belted m.d., 8" overhang
No. 2LMS Leland-Gifford, single spindle, High Speed, m.d.
No. 2LMS Leland-Gifford, H.S. Hydraulic Feed, m.d.
2 spindle No. 2 Avey High Speed, belted, m.d.
2 spindle No. 2B MA1 Avey Production Type, m.d.
2 spindle Avey, size No. 1, Type B, style VHP, m.d., 8" overhang
2 spindle No. 3MA6 Avey High Speed, m.d.
2 spindle No. 2 Leland-Gifford High Speed, 8" overhang, m.d.
3 spindle No. 2MA6 Avey High Speed, m.d.
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No. 4-48" Defiance Machine Co. Drill, m.d.
No. 201¼ Barnes Single Sp. Self-Oiling All Geared Drill & Tapper, 1943
No. 242 Barnes Single Sp. Self-Oiling All Geared Drill & Tapper
No. 417 Baker, m.d.
No. 513 Baker, m.d.

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No. 4 Fellows Enveloping Gear Generator, m.d.
No. 12 Fellows Gear Shaving Machine, m.d., late
No. 6 Fellows, belt drive
No. 7, 7A Fellows Gear Shapers, belted m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
No. 61 Fellows, belted motor drive
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GRINDERS, SURFACE, 72" No. 72 Hanchett rotary, new 1946.
SURFACE GRINDER, No. 1½ Abrasive, serial 786, late.
MILL, No. 2 Cincinnati plain horizontal, serial 4A2PIK17, late.
HAMMER, Chambersburg No. 3C pneumatic, late
LATHES, TURRET, No. 5 Gisholt ram type universal, new 1940
MILL, No. 34-36 Cincinnati duplex mill, serial 3B33DIH-4, late.
GRINDER, 4" x 12" Model 4H Landis plain cylindrical, new 1943.
LATHES, ENGINE, 14" x 6' bed Handey toolroom. Timken, 1940.
LATHES, MFG., Model 10 Sundstrand automatic, front & rear slides, new 1942.
LATHES, TURRET, No. 3 Gisholt universal (2) late.
LATHES, TURRET, 36" and 42" Bullard New Era vertical.
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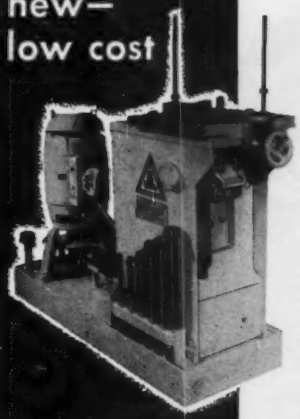

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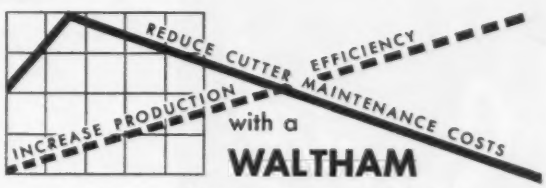

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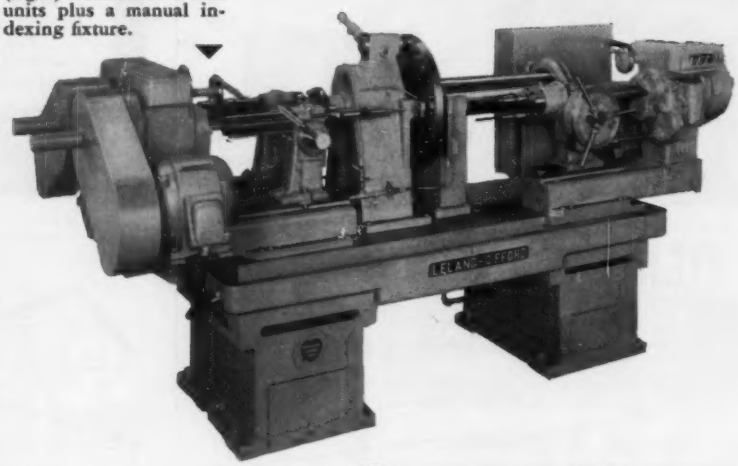

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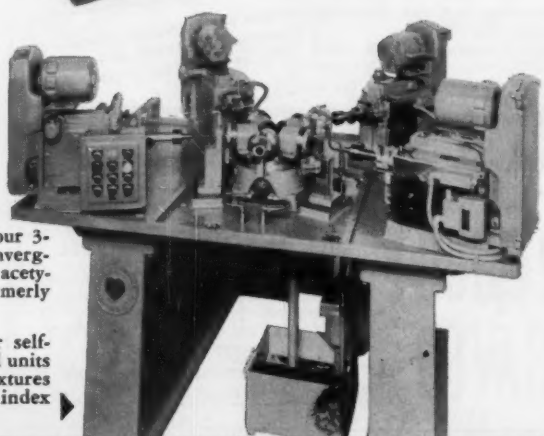

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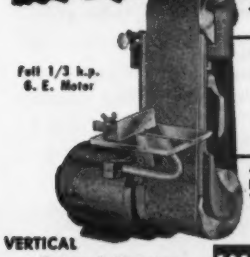

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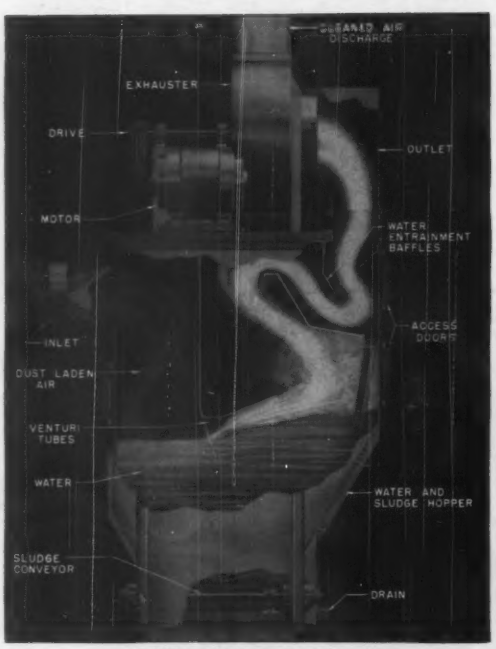
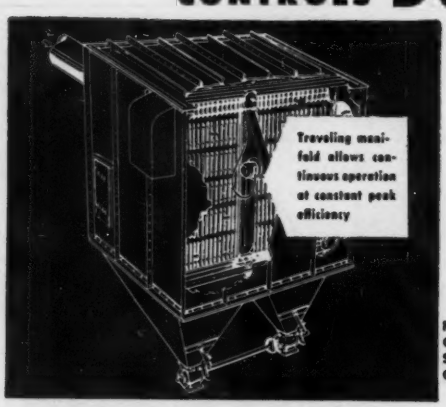
NOW—Great news about two new Pangborn Dust Collectors!



PANGBORN VENTRIJET WET COLLECTOR

These two new developments in industrial dust control by Pangborn are designed to handle any dust problem! The new Pangborn Self-Cleaning Collector utilizes a traveling reverse air manifold for continuous operation at constant peak efficiency. Use the new Pangborn Ventrijet for effective control of dusts a dry collector cannot handle! For complete information, write to: PANGBORN CORPORATION, 1200 Pangborn Boulevard., Hagerstown, Maryland.

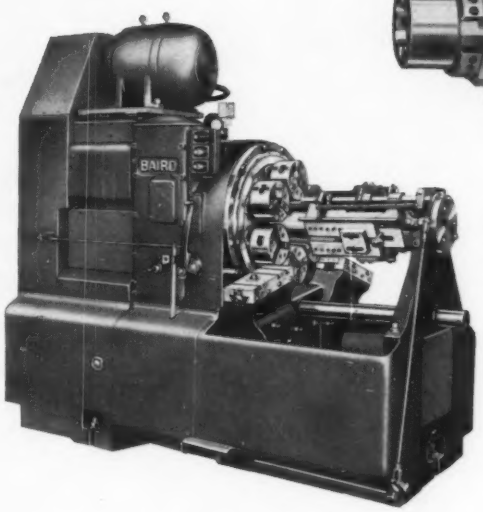
Pangborn CONTROLS DUST.

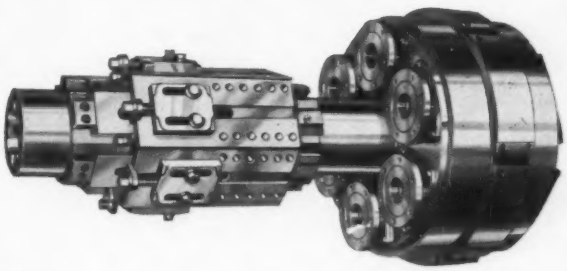


PANGBORN CONTINUOUS SELF-CLEANING COLLECTOR

For more information fill in page number on Inquiry Card, on page 231

...ask BAIRD about it





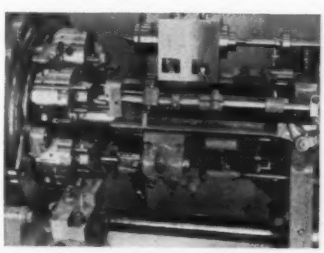
Spindle carrier showing longitudinal bar with individual tool slides, each mounted on hardened and ground ways and bearings and each having micrometer adjustment. Slides at last work station have adjustment for taper turning.

Why the preference for BAIRD Chuckers?

Aside from the fact that the Baird 76-H Chucker has enough outstanding design features and advantages to fill a 12-page brochure (which we will be glad to send you on request), there are two main reasons for its popularity.

One is the unique versatility in tooling provided by an essentially simple, "clean" design which at the same time permits exceptional scope in variety and sequence of operations and cycles . . . including complete automation.

The other is the manner in which Baird Engineering tackles an *individual* customer's problem. Here you get the benefit of our years of work with the nation's top high-production specialists . . . a staff of chucker experts, backed by exceptional tooling and test facilities. When a Baird Chucker reaches the production line, promised performance *can* be achieved . . . and manitained.



An example of versatile Baird 76-H Chucker tooling for finishing a die cast aluminum end plate, single-indexing, including recessing tool for back-facing . . . high speed boring heads, two-spindle lead screw tapping attachment. Production: 420 pieces per hour.

Our case history files almost certainly contain the start of a profitable answer to YOUR problem in high-speed repetitive production. Before you decide on methods or machines, it will pay you to "Ask Baird About It." Write Dept. M.

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING EQUIPMENT • AUTOMATIC FEEDERS • TUMBLING BARRELS

THE BAIRD MACHINE COMPANY

STRATFORD CONNECTICUT

SBA56

How TIMKEN® bearings maintain spindle precision, accurate gear mesh on extra heavy-duty lathe

AT the flick of a lever, the operator of this Warner & Swasey 1-A *extra heavy-duty* lathe can get any one of 16 spindle speeds immediately. Then, with the right speed for the job, this lathe can hog off a lot of metal fast—and still turn out close-tolerance parts.

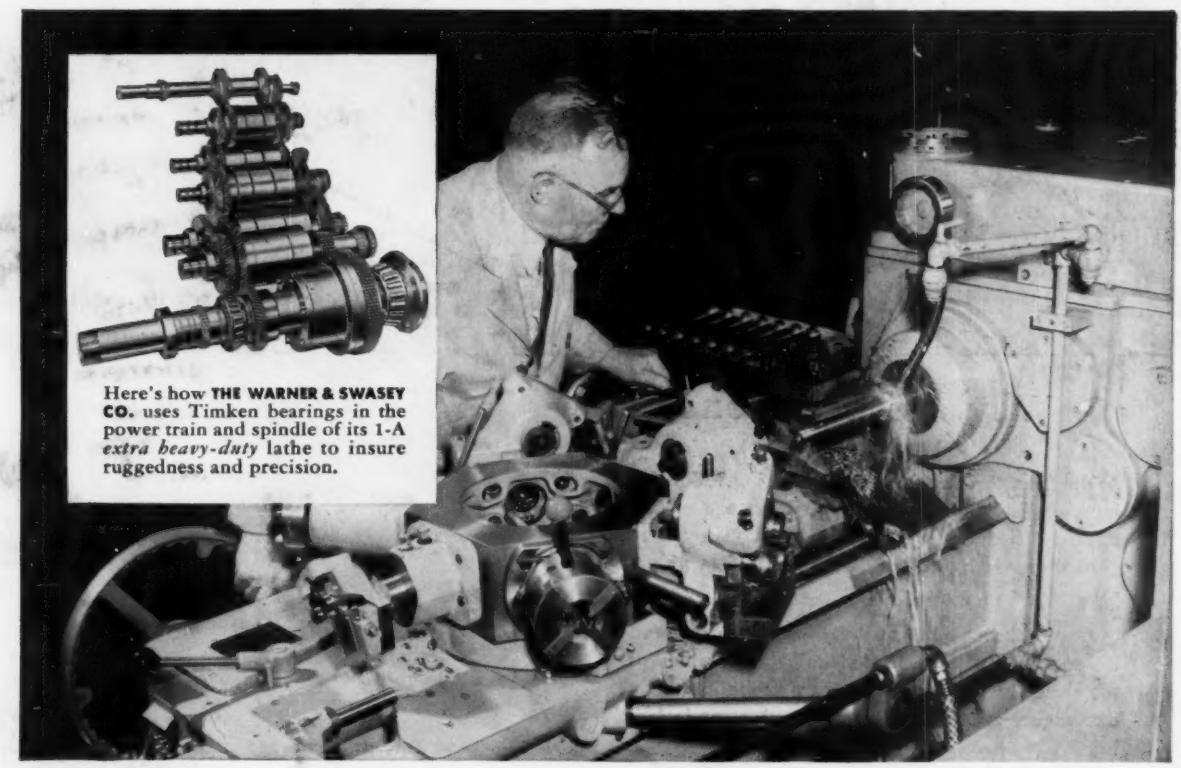
To help assure both precision and ruggedness, at any speed, Warner & Swasey engineers have mounted the spindle and gear train on Timken® tapered roller bearings. Timken bearings maintain spindle precision and accurate gear mesh day in and day out, piece after piece. They're tapered to take both radial and thrust loads, in any combination. Full line contact between rollers and races provides maximum capacity. Shafts are held in alignment. Gear mesh is smoother, more accurate. Shaft wear is eliminated, gear wear reduced.

True rolling motion, plus almost microscopically smooth surfaces combine to make Timken bearings practically friction-free. They're made from Timken fine alloy steel—steel that's nickel-rich for extra toughness. We're the only bearing manufacturer in America that makes its own steel. Rollers and races of Timken bearings are case-hardened for hard, wear-resistant surfaces and tough, shock-resistant cores.

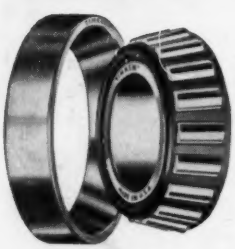
No other bearings can offer you all the advantages of Timken bearings. That's why so many manufacturers of fine equipment use them. Whether you build or buy machinery, be sure to specify Timken bearings. And look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN BEARING EQUIPPED

This symbol on a product means its bearings are the best.



Here's how **THE WARNER & SWASEY CO.** uses Timken bearings in the power train and spindle of its 1-A *extra heavy-duty* lathe to insure ruggedness and precision.



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

REVOLUTIONARY BUCYRUS PLANT HELPS HOLD DOWN RISING COSTS

At a new plant in Bucyrus, Ohio, the Timken Company has substantially reduced the cost of tapered roller bearings by: 1) producing these bearings under a new system of extreme mechanization; 2) standardizing on 13 bearing sizes with the widest applications throughout industry. Manufacturers can take advantage of these lower costs by redesigning applications to use these Bucyrus sizes. And as more switch to Bucyrus bearings, production costs can drop still further, meaning even lower costs to you.

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ▯ AND THRUST →▯← LOADS OR ANY COMBINATION →✳←